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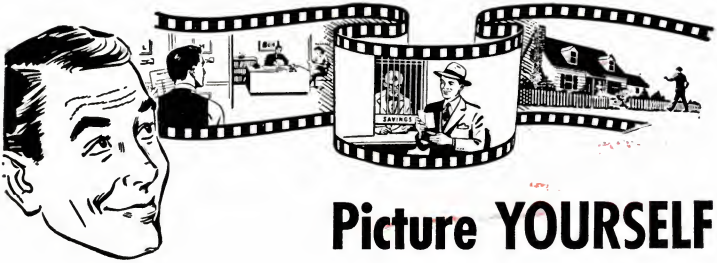

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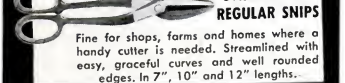

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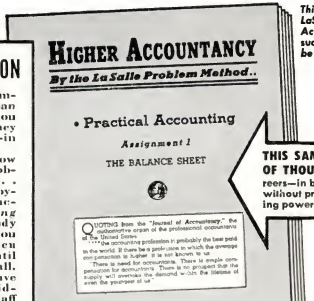

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IF you have been envying the high incomes and good jobs enjoyed by thousands of men and women Accountants today... incomes ranging from $4,000 to $10,000 and more per year... why not launch such a career for yourself?

Do you doubt that you can?

Then let us send you—without cost or obligation—the same Lesson Number One with which LaSalle has started several hundred thousand men and women toward successful accounting careers. We want you to see for yourself how this remarkable method, originated by LaSalle, makes Accountancy simple, interesting, practical, and certain . . . how it leads you step-by-step to a complete mastery of Accounting—and on up to the coveted degree of Certified Public Accountant if you so aspire.

It doesn't matter whether you've had previous bookkeeping experience, or whether you don't know a debit from a credit. Whether you wish to qualify as an expert bookkeeper, advanced accountant, cost accountant, auditor, government accountant, income tax specialist, or public accountant . . . you'll find in LaSalle's Problem Method the exact plan to prepare you rapidly and inexpensively—in spare hours at home—without losing a day from your present job.

So right now, today . . . if you are an adult, employed, and earnestly ambitious for rapid advancement in this highest-paying of all professions . . . send your name and address on the coupon below. We'll send the free sample lesson—plus our 48-page book outlining today's career opportunities and how you can qualify for them. A coupon like this has started many thousands toward greater success. It can do the same for you. Mail it today!

Clip Coupon . . . Mail TODAY!

LaSalle Extension University . . . *A Correspondence Institution*
Dept. 283H, 417 S. Dearborn Street, Chicago 5, Illinois

YES, I want to see how LaSalle's "Problem Method" works.. how I can qualify for high-pay Accountancy positions. Send Free Sample Lesson — also your 48-page book, "Accountancy, the Profession That Pays" ...all without cost or obligation.

Name.....*Age*.....

Street Address.....

City, Zone & State.....

Present Position.....

We'll train & establish you in

Your Own Business

. . . even if now employed

We are enlarging this 24-year-old world-wide chain of Duraclean dealerships. Many excellent locations are still available in the U.S.A., Canada, and other countries. If you are reliable and diligent, this is an opportunity to increase your income . . . and have the freedom, financial independence, and prestige of YOUR OWN business.

These are full time dealerships . . . but you can start in spare time and have a profitable, lifetime business when your present job ends. A Duraclean dealer will train and assist you. He'll receive his successful, proven methods and sales plans. He'll work with you.

Alert dealers can average $5 hourly gross profit on service they render plus $3 on EACH service-man at National Price Guide charges. This business is easy to learn . . . quickly established.

You Become an Expert

in cleaning and protecting Rugs and Upholstery

DURACLEAN cleans by *absorption*. It eliminates scrubbing . . soaking . . shrinkage. Aerated foam, created by electric Foamovator, restores the natural lubrication of wool and other animal fibers in rugs and upholstery. Dirt, grease and many unsightly spots vanish. Fabrics and floor coverings are cleaned with a *new consideration for their life and beauty.*

This modern process avoids strong soaps and machine scrubbing! This eliminates unnecessary wear and the breaking of fibers. Fabric life is increased.

DURACLEANING is done *in the home.* Customers like this convenience. Fabrics dry in a few hours. Rug pile again stands erect and even. Brilliant colors revive. Furnishings become clean, fresh and enlivened.

DURAPROOF is another year 'round service rendered in the home, office or institution—*without removing furnishings.* It protects upholstery, rugs, furs, clothing and auto interiors against damage by moths and carpet beetles. U. S. Government says **"Moths are present in practically every household . . No section of country seems free from such infestations." DURAPROOF** kills moths and carpet beetles . . it makes materials non-eatable to both. **DURAPROOF** is the ONLY moth-proof service backed by an International Money Back, 4-Year Warranty.

Easy to Learn • No Overhead Expense

Permanent, Growing Market

Service is rendered **IN** homes, offices, hotels, theaters, institutions and to revive used-car upholstery for auto dealers. There is need for these services in almost every building. Duraclean dealers operate from their home, an office or shop, as they prefer. It's **easy to learn** . . . we quickly train you. Rendering service yourself, at first, prepares you to train and supervise service men.

Repeat and Voluntary Orders

Demonstrations win new customers.

DURACLEAN Dealers find REPEAT and VOLUNTARY orders a major source of income. Customers, enthused with results, tell friends and neighbors. Furniture and department stores and others turn over rug and upholstery cleaning and mothproofing to **DURACLEAN** Dealers. We show you **27 ways** to get new customers.

Two-Way Profit

You enjoy big profits on BOTH materials and labor—after paying service men and salesmen. This is a year-round large-profit business. You have the cooperation of a **24 YEAR OLD** organization interested in your success. If you want to become the owner of a **DURACLEAN** Service business, you should inquire now, TODAY, while territory is still available.

What Dealers Say

W. Lookiebill: We've had 20 years of pleasant dealings. I'm 65 but am setting my sights for 20 more years.
Gerald Merriman: $700 cleaning . . only 13 working days.
F. D. Freidinger: 70% of our business is repeat.
A. Ullman: Every demonstration has been a sale.
Ellsworth: Your advertising certainly has paid dividends.
M. Lassanske: My original investment was returned in about two months. I am not sorry in any way that I started my business 'on a shoe string.'
R. Kinbrough: Finished First White House of Confederacy and am to **Duraclean** the Governor's Mansion.
Margarette Turner: Took in $106 in 15 or 18 hours.
L. Johnson: Each customer leads to 3 or 4 more.
T. Komori: We have 1,000,000 yen contract Duracleaning for U. S. Army in Japan.

EASY TERMS

A moderate payment establishes your own business—pay balance from sales. We furnish electric machines, folders, store cards, introduction slips, sales book, demonstrators and enough material to return your TOTAL investment. Your business can be operating in a few days. Mail coupon today! No obligation.

Duraclean Co. 4-182 Duraclean Bldg. DEERFIELD, ILLINOIS

Nationally Advertised

Your services are Nationally Advertised in Life, McCall's, Better Homes & Gardens, Ladies Home Journal, House & Garden, Maclean's (Canada's largest magazine). **New Yorker, House Beautiful, and others.**

FREE Booklet

Our first letter and illustrated booklet will explain everything—the two modern, urgently needed services, waiting market, how business grows, your large profit, easy terms and PROTECTED territory. Send Coupon TODAY!

"OWN a Business" Coupon

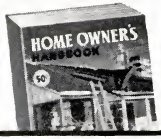
DURACLEAN CO., 4-182 Duraclean Bldg., Deerfield, Illinois

With no obligation to me, send booklet and letter giving full details. Tell me how I may OWN a growing business of my own built upon satisfied customers.

Name_____

Address_____

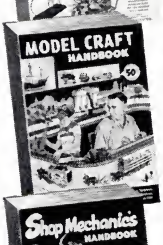
City_____ State_____



Which of these How-to-Do-It Books Do You Want for Only 50¢?

8 Big Illustrated Books • Everyone a Gold Mine of Ideas for Making and Repairing Things

Here's a whale of a bargain! 8 big books that show you exactly "how-to-do-it" and get professional results every time! Every one is jam-packed with pictures and simple step-by-step directions. Only 50c each. (Or even better, you can have all eight for only $3.) Just pick the ones you want—rush coupon below while present supply lasts! Money back if not delighted.



1 RADIO-TV EXPERIMENTER... Over 40 electronic projects. How to make TV repairs; Big Picture TV; Alarm Clock Radio; Talking Light Beam; Geiger Counter; Novice-class Transmitter; Electronic Organ; Short Wave Converter; Portable Superhet; Vestpocket Radio; Pocket-Size Tube Checker; Remote Control Door Opener, plus many other fascinating projects. 192 pages.

2 HOME OWNER'S HANDBOOK... Save money on remodeling, weatherproofing, insulating, heating & wiring, installing TV, building furniture, tricks with linoleum, combination storm & screen sash, how to lay asphalt shingles, installing wall switches, gardening, outdoor barbecue, plus nine attractive plans for medium-priced homes. 192 pages.

3 HANDYMAN'S ELECTRICAL GUIDE... Shows how to do electrical work like a "pro"! Everything from repairing toasters to winding motors. Servicing Fans, Lamps, Irons, Vacuum Cleaners, Clocks, Electric Mixers, etc., etc. Your first repair job can save you many times the low cost of this handy book. 192 illustrated pages.

4 CRAFTSMAN'S HANDBOOK. Over 60 useful things to make—Tables, Cabinets, Captain's Chair, Early American Furniture, Simple Upholstery, Dressing Table-Desk, Toys, Sailing Dinghy, Wall Bracket, How to do Veneering, Wall Safe, Pantograph, Functional Furniture, and much, much more. 192 illustrated pages.

SPECIAL All 8 FOR ONLY $3.00

5 BOAT BUILDER'S HANDBOOK... 33 boats you can build yourself. Everything from sailing dinghy to cabin cruiser. Duck boats, hydroplane racer, kayak-canoes, motor sailer, sea sled, rowboat, runabout, folding boat, scow sailer, all-purpose sloop. How to take care of your boat, tips on care of outboard motor. How to recondition your boat, make full-size boat plans, etc., etc. 192 pages.

6 CRAFTWORK... Fascinating projects using simple tools. Decorative Candle-making, Chip carving, picture framing, floral jewelry, hooked rugs, ceramic mold making, silversmithing, wire bending, pewter platters, wood carving, making molds, hand-made tie clips, sandals, and many other projects, plus a complete course in leathercrafting. 192 pages.

7 MODEL CRAFT HANDBOOK... A prize collection of 44 model projects—Model Railroad and Circus, Working Jet Engine, Famous Guns, Airplanes, Antique Autos, Gas and Steam Engines, Tallyho Coach, Model Racing Yacht, Remote Radio Controlled Cabin Cruiser, 1812 Cannon, 1850 Station Wagon, etc., etc. 192 big pages, many pictures.

8 SHOP MECHANIC'S HANDBOOK... Everything you want to know about building and using home workshop tools. Lathe, Bench Grinder, etc. Treasury of ideas. 192 pages.

—RUSH THIS ORDER FORM—

Science & Mechanics Magazine, Dept. 244B
450 East Ohio Street, Chicago 11, Illinois

Enclosed is $_____. Please send the books whose numbers I have encircled below. (Numbers correspond with descriptions above.)

or ☐ CHECK BOX TO GET ALL 8 BOOKS ($4.00 VALUE) $3.00

1 2 3 4 5 6 7 8

NAME_____

ADDRESS_____

CITY, ZONE & STATE_____

SAVE MONEY! If you order 2 or more books, you save 10c on each book! On 2 books, you deduct 20c; on 3 books 30c, etc. All 8 for only $3.00.

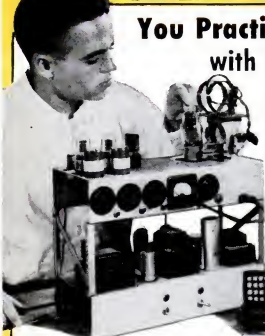
Our 40th Year

NRI training is thorough, practical, up-to-date. When you enroll with NRI you benefit from our 40 years of successful experience training men at home.

J. E. Smith

President
National Radio Institute
Washington, D. C.

I'll Train You RADIO-

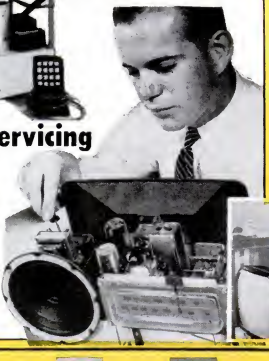


You Practice Broadcasting with Parts I Send

As part of my Communications Course I send you parts to build low-power Broadcasting Transmitter at left, and other equipment. Use it to get practical experience. You put this station "on the air," perform procedures demanded of station operators. An FCC Commercial Operator's License can be your ticket to a bright future. My Course trains you to get your license. Mail Coupon now!

Television Is Today's Good Job Maker

Television now reaches from coast-to-coast. More than 25 million Television sets are already in use and require servicing; thousands more sets are being sold every week. About 200 TV stations are now on the air with hundreds more being built. This means new jobs, more jobs, better pay for trained men. The time to act is NOW! Start learning Radio-Television servicing or communications.



You Practice Servicing with Parts I Send

Nothing takes the place of PRACTICAL EXPERIENCE. NRI training is based on LEARNING BY DOING. You use parts I send to build many circuits common to Radio and TV. You build the modern radio at right. Use Multi-tester you build to make money fixing sets. Many students make $10, $15 a week extra fixing neighbors' sets in spare time, starting soon after enrolling. All equipment I send is yours to keep.

Make Extra Money in Spare Time While Learning

Keep your job while training. Many NRI students make $10, $15 and more a week extra fixing neighbors' Radios in spare time. The day you enroll I start sending you special booklets that show you how to service sets. Multi-tester you build helps discover and correct Radio troubles, gives PRACTICAL EXPERIENCE on circuits common to radio and TV. Mail coupon today.

I Trained these Men at Home

Laborer Finds Success in Radio-TV

"I was a laborer with no future. Now I have a position that pays well. My spare time servicing pays good money, too. Thanks to NRI."—Robert Ford, Johnstown, Pa.

Switched to TV Servicing

"I recently switched from studio work and am now holding a position as TV service technician. Enjoy my work more and more."—Norman Ward, Ridgefield Park, N. J.

Paid for Course, Car in Spare Time

"By the time I graduated I had paid for my course, a car and testing equipment. I can handle any job in Radio-TV."—E. J. Streitenberger, New Boston, Ohio.

$10 to $15 Week Spare Time

"Four months after enrolling, was able to service Radios . . . averaged $10 to $15 a week spare time. Now have full time business."—W. Weyde, Brooklyn, N. Y.

Employed as Transmitter Operator

"A former employer recommended NRI training to me. Now employed as transmitter operator in Harrisburg."—Albert Herr, New Cumberland, Penna.

AT HOME for Good Jobs in TELEVISION

There is Success-Good Pay-Security for You in America's Fast Growing Industry

NRI Training Leads to These Jobs in RADIO-TELEVISION

BROADCASTING
Chief Technician
Chief Operator
Power Monitor
Recording Operator

SERVICING
Home and Auto Radios
Television Receivers
P.A. Systems

MANUFACTURING
Design Technician
Service Manager
Tester
Research Assistant

SHIP AND HARBOR RADIO
Chief Operator
Radiotelephone Operator
Assistant Operator

GOVERNMENT RADIO
Operator in Army, Navy, Marine Corps
Airways Operator
Forestry Dispatcher

AVIATION RADIO
Transmitter Technician
Airport Transmitter Operator

TELEVISION
Pick-up Operator
Television Technician
Remote Control Operator
Service and Maintenance Technician

POLICE RADIO
Transmitter Operator
Receiver Serviceman

Control Operator, Station WEAN

"Received my License and worked on ships. Now with Station WEAN. NRI Course is as complete as any radio course can be." —Haymond E. Arnold, Rumford, L. I.

Available to VETERANS under G.I. Bills

DO YOU want good pay, a job with a bright future, security? Would you like to have a profitable business of your own? If so, find out how you can realize your ambition in the fast-growing RADIO-TELEVISION industry. Even without Television, the industry is bigger than ever before. Just think, over 115 million home and auto Radios, 3000 Radio Broadcasting Stations, plus 25 million Television sets and about 200 Television Broadcasting Stations. Expanding use of Aviation and Police Radio, Micro-wave Relay, Two-way Radio for busses, taxis etc., are making opportunities for Servicing and Communications technicians and FCC Licensed Operators.

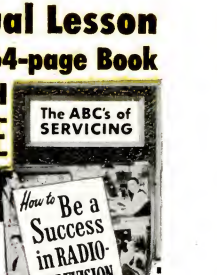
My Training Includes Television

You get practical experience by working on circuits common to both Radio and Television. My graduates are filling jobs, making good money in both Radio and Television. Many NRI trained men start their own Radio and Television servicing business with capital earned in spare time. Let me show you how you can be your own boss; earn $10 to $15 a week extra even while still learning. Now is the time to get ready for success in Radio-Television. Coupon below brings you Actual Lesson and 64-page book.

Find Out What Radio-Television Offers You

What will YOU be doing one year from today? Decide now that you are going to know more and earn more. ACT NOW. Send the coupon below NOW for my FREE DOUBLE OFFER. You get Actual Servicing Lesson. Also my 64-page Book, "How to Be a Success in Radio-Television." Read what my graduates are doing, earning, see equipment you practice with at home. Mail coupon now. Send in envelope or paste on postal. J. E. SMITH, President, Dept. 4BB National Radio Institute, Washington 9, D. C. Our 40th Year.

Actual Lesson and 64-page Book BOTH FREE



MAIL THIS NOW!

MR. J. E. SMITH, President, Dept. 4BB
National Radio Institute, Washington 9, D. C.
Mail me Sample Lesson and 64-page Book, FREE. (No salesman will call. Please write plainly.)

Name..... Age.....
Address.....
City..... Zone..... State.....

VETS write in date of discharge .....

Get where the BIG MONEY is!

The thousands of newspaper and magazine ads you read . . . the television and radio commercials you hear . . . the mail order ads you receive . . . the billboards you see . . .

All of this, and lots more from catalogs and advertising folders to house organs, DOESN'T GROW ON TREES! It's prepared by advertising men and women who are among the highest paid groups in the world. From Hollywood to New York . . . in cities and in towns . . . there are glowing opportunities almost everywhere!

Learn ADVERTISING!

TELEVISION! RADIO! MAIL ORDER! MAGAZINE! NEWSPAPER! INDUSTRIAL! DIRECT MAIL! NOVELTY! POSTERS! etc.

NOW! TRAIN AT HOME FOR THIS FASCINATING, WELL PAID WORK!

Maybe you've thought of a career in advertising as something beyond your reach. But it isn't!

Here, in one giant, 812-page book is just the help you need!

PRACTICAL ADVERTISING is written to be studied at home. It guides you through every step of this fascinating work. From magazine to newspaper ads; from mail order to television; from market research to space and time buying; from writing ads to making layouts, artwork and photography and literally hundreds of other subjects—even to writing jingles—everything is clearly explained.

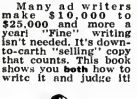
Hundreds of people now in big pay advertising jobs got their basic training from this book. Thousands of copies are used in leading schools and colleges and for home study.

Never before has modern advertising been explained so simply and fully. The author, a well-known advertising agency president, put everything into PRACTICAL ADVERTISING he himself would expect a job applicant to know . . . and lots more besides.

It is specifically written for beginners. No previous advertising training is needed. It guides you step by step. Vast opportunities are pointed out and you learn how to start cashing in on them—whether with an ad agency, an art or photo studio, in the ad department of a business or the place you now work, or as a free lance or spare-time ad expert.

LIKE TO WRITE?

Many ad writers make $10,000 to $25,000 and more a year! "Fine" writing isn't needed. It's down-to-earth "selling" copy that counts. This book shows you **both** how to write it and judge it!



LIKE TO DRAW?

You don't need to be able to draw "art exhibit pictures" to be a whiz at ad layout. There's a big place in advertising for those with art and photo talents—and this book teaches you the work step by step.

Ideas pay off big in advertising — and here you learn how to produce them as well as "cash in" on them.

Other big opportunities exist in ad research for those good at figures . . . in selling for those who like to sell . . . in TV or radio programming for those who know music and dramatics . . . and so on down a long list.

EXTRA! 72-PAGE TELEVISION SUPPLEMENT AND PRACTICE BOOK NOW INCLUDED

From first page to last, PRACTICAL ADVERTISING can open your eyes to unsuspected opportunities where your head can earn you lots more than your hands ever could!

IN ADDITION, you also get the new 72-page TELEVISION SUPPLEMENT AND AD WORKBOOK. You learn how TV commercials and programs are put "on the air" from "storyboard" to screen. Included are sample scripts, program ratings, and full data on such things as scenic effects, dramatic action, eye catchers, etc.

IT'S ALL HERE!

Nothing is omitted or condensed. Following are a few of the subjects covered:

Opportunities in advertising; How ads build business; Best advertising appeals; How to write ads; Slogans; Jingles; Artwork and Photos; Layouts; Tricks of the trade; Getting ads ready to print; Plates; Electros; Mats; Printing and how to buy it; Getting free publicity; A course in mail order; Buying space and time; Research and testing; House organs; Catalogs and other advertising literature; Sales letters; Trademarks and brand names; Planning campaigns; How agencies operate; Advertising jobs and how to get them. . . . **and literally hundreds of others.**

Together, the two books bring you 914 pages of the finest advertising training available. You get them both for the special price of only $6.95 (regular price $7.75). 537 illustrations explain things simply as A-B-C. 690 self-test questions help you analyze your progress. 110 interesting assignments get you started on typical ad work with the very first chapter!

Use coupon for 10-DAY FREE TRIAL. Send to Rinehart Books, Inc., 232 Madison Ave., New York 16, N. Y. You be the judge!

Send No Money! PRACTICE 10 DAYS FREE!

Rinehart Books, Inc., Technical Div.,
232 Madison Ave.,
New York 16, N. Y.

Sure! Send the 842-page PRACTICAL ADVERTISING training book PLUS the 72-page TELEVISION SUPPLEMENT and WORKBOOK for 10-day Free examination. In 10 days I will remit the complete purchase price of $6.95 (plus a few cents postage) or return books to you postpaid and owe you nothing.

Name.....

Address.....

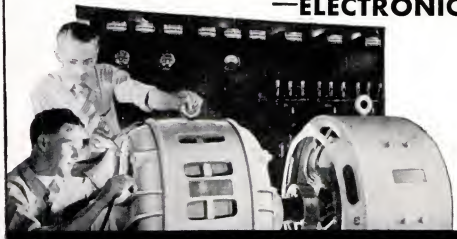
City, Zone, State.....

THESE MEN ARE GETTING PRACTICAL TRAINING

IN ELECTRICITY

—ELECTRONICS

On Real:



A.C. and D.C. MOTORS
GENERATORS
SWITCHBOARDS
CONTROLLERS
WIRING JOBS
APPLIANCES
ELECTRONIC UNITS

(Shown at left—Instructor explaining operation and testing of a large Motor Generator in our A.C. Department.)

AND TELEVISION-RADIO

On Real:

TELEVISION SETS
RADIO RECEIVERS
F.M.
(Frequency Modulation)
ELECTRONICS
RECORD CHANGERS
AUTO RADIOS
PUBLIC ADDRESS Systems

(Right—Instructor helping students check the wiring and trace circuits of television receivers)

Train in the great SHOPS of COYNE

For These Opportunity Fields!

Trained men needed whether 17 or up to 45. Prepare quickly at Coyne for better rating, if drafted—a vital job in industry, if not, in A FIELD THAT ALSO OFFERS A REAL FUTURE IN THE YEARS AHEAD.

FINANCE PLAN Enroll now, pay most of tuition later. **Special plan for men of draft age.**

WE TRAIN YOU IN CHICAGO. At Coyne you learn on real, full-size equipment. Trained instructors show you how, then you do practical jobs yourself. No previous experience or advanced education needed.

CLIP COUPON NOW for big new illustrated **Coyne** book. Check whether interested in ELECTRICITY or TELEVISION-RADIO or both. No obligation; no salesman will call. Get vital facts now!

B.W. COOKE President **COYNE** ELECTRICAL SCHOOL FOUNDED 1899

A TECHNICAL TRADE INSTITUTE CHARTERED NOT FOR PROFIT
500 S. PAULINA, CHICAGO, Dept. 24-73H
ELECTRICITY ★ RADIO ★ TELEVISION ★ REFRIGERATION ★ ELECTRONICS

Mail Coupon for BIG FREE BOOK!

APPROVED FOR VETERANS

B. W. COOKE, President
COYNE ELECTRICAL SCHOOL
500 S. Paulina St., Chicago 12, Ill. Dept. 24-73H

Send BIG FREE book and details of your training offer. This does not obligate me and no salesman will call. I am interested in:

☐ ELECTRICITY ☐ TELEVISION-RADIO

NAME .....

ADDRESS.....

CITY.....STATE.....

An Amazing Invention—"Magic Art Reproducer"

DRAW ANY PERSON IN ONE MINUTE

NO LESSONS! NO TALENT!

You Can Draw Your Family, Friends, Anything From REAL LIFE—Like An Artist... Even if You CAN'T DRAW A Straight Line!

Anyone can Draw With This Amazing New Invention—Instantly!

De Luxe Model Complete for only **$1.98**

—With extra high power, extra clear and sharp "reproducer" unit.

A New Hobby Gives You A Brand New Interest!

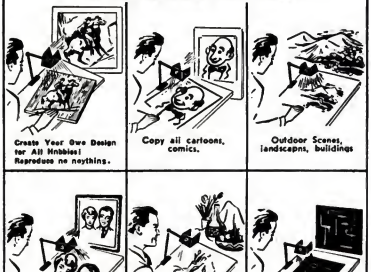
Yes, anyone from 5 to 80 can draw or sketch or paint anything now . . . the very first time you use the "Magic Art Reproducer" like a professional artist—no matter how "hopeless" you think you are! An unlimited variety and amount of drawings can be made. Art is admired and respected by everyone. Most hobbies are expensive, but drawing costs very little, just some inexpensive paper, pencils, crayons, or paint. No costly upkeep, nothing to wear out, no parts to replace. It automatically reproduces anything you want to draw on any sheet of paper. Then easily and quickly follow the lines of the "picture image" with your pencil . . . and you have an accurate original drawing that anyone would think an artist had done. No guesswork, no judging sizes and shapes! Reproduces black and white and actual colors for paintings.

Also makes drawing larger or smaller as you wish.

Anyone can use it on any desk, table, board, etc.—indoors or outdoors! Light and compact to be taken wherever you wish. No other lessons or practice or talent needed! You'll be proud to frame your original drawings for a more distinctive touch to your home. Give them to friends as gifts that are "different," appreciated.

Have fun! Be popular! Everyone will ask you to draw them. You'll be in demand! After a short time, you may find you can draw well without the "Magic Art Reproducer" because you have developed a "knack" and feeling artists have—which may lead to a good paying art career.

ALSO EXCELLENT FOR EVERY OTHER TYPE OF DRAWING AND HOBBY!



Create Your Own Design for All Hobbies! Reproduce no anything.

Copy all cartoons, comics.

Outdoor Scenes, landscapes, buildings

Copy photos, portraits of family, friends, etc.

Still life, vases, bowls of fruit, lamps, furniture, all objects.

Copy blueprints, plans.

FREE!

"How to Easily Draw Artists' Models"

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Learn how to protect your invention. The U. S. Patent Laws provide that any new and useful art, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if the act of invention is involved. Therefore, every inventor with a valuable invention should take advantage of the Patent Laws and proceed for patent protection in order to safeguard his rights.

A patent gives the inventor the exclusive right to prevent others from making, using, or selling the invention claimed in the patent for a period of seventeen years.

The Patent Laws were enacted for the benefit of the inventor to give him protection for the features of his invention which are patentable. These features must be properly and concisely set forth and claimed in a formal application for patent, in order to comply with the requirements of the Patent Laws. For that reason, unless the inventor is familiar with patent matters, he should engage a competent registered patent attorney or agent to represent him. We are registered to practice before the U. S. Patent Office and are prepared to serve you in the handling of your patent matters.

A specially prepared booklet entitled "Patent Guide for the Inventor", containing detailed information with respect to patent protection and procedure, together with a "Record of Invention" form will be promptly forwarded to you without obligation upon request.

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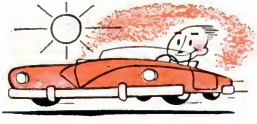
Letters—

What Makes a Car Safe?

For years I've wanted to own a convertible. But whenever I mention the old yearning to my family or a plain-spoken friend, I hear the ancient wail: "They're death traps. You haven't got a chance if you should roll over in one."

Well, maybe I haven't. But what's the likelihood of a convertible's rolling over, these days? The center of gravity in cars has been getting lower for years. I suspect that



one of these new, ground-hugging open jobs is almost as hard to overturn as a tank.

Who's to say how much safer I'd be in a sedan or a station wagon or even a hard-top convertible? Has anybody ever measured how much safer one body style is than another?

THEODORE DEWARE, Brooklyn, N.Y.

There's a touch of the convertible-lover in all of us, so we handed on your questions to the National Safety Council, the Automobile Manufacturers Association, three big state police departments and several leading insurance companies. And what do you know? Nobody could answer them.

Cornell University's crash-injury research program may provide some answers for you in about a year.

In the meantime, drive carefully, and you won't roll over in anything.

Reading Backwards Makes Sense

Ralph C. Finn's letter entitled "Who's Nuts?" [Nov., p. 16] shows that *he* isn't.

Most intelligent, deep-thinking men look

INVENTORS

If you believe that you have an invention, you should find out how to protect it. The first step is to have a search made of the prior pertinent U. S. patents. If a report on this search indicates that the invention appears patentable you can apply for a patent, and the specifications and claims should be prepared.

The firm of McMorrow, Berman & Davidson, with offices in Washington, D. C., is qualified to take the necessary steps for you. We can make a preliminary search on your invention, advise you whether we think it can be patented, and prepare your application for patent.

Unless you are fully familiar with the U. S. Patent Laws, we recommend that you engage the services of a Registered Patent Attorney to protect your interests. The patent laws are *your* laws. A patent gives you the right to prevent others from making, using or selling the invention claimed in your patent for a period of 17 years.

Use these patent laws for your protection. Investigate whether your invention can be patented. If you have what you believe to be an invention, we suggest that you have this firm make a search for you.

Send for a copy of our Patent Booklet entitled "How To Protect Your Invention," containing information about patent protection and patent procedure. Along with this we will also send you an "Invention Record" form, for your use in writing down and sketching details of your invention. We will mail them promptly. No obligation. They are yours for the asking.

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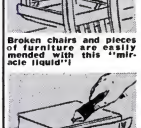

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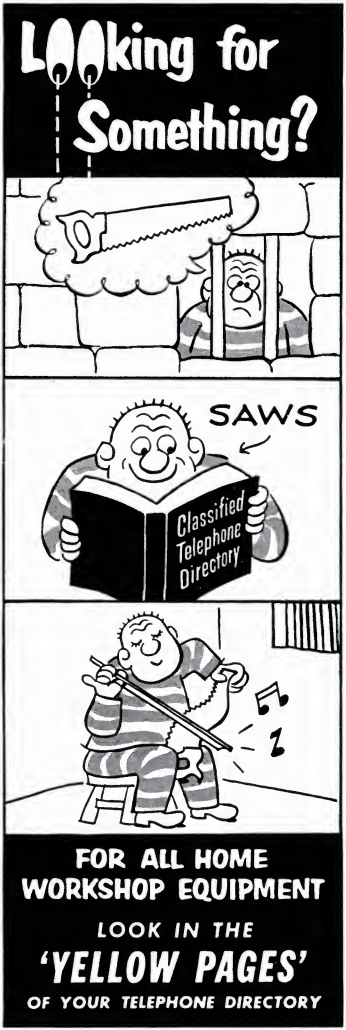

at a magazine from the back to the front. And before we get too many scoffs from the distaff side, let's look at the facts ("Just the facts, Ma'am").

It is well known that women outlive men, and the reason given by one author is that we wear ourselves out running

around waiting on them, while they stand around conserving their energy and consequently outlive us.

If we men are to survive, we must also start conserving our energy. So, why spend so much of it turning pages from right to left, moving the left thumb each time to hold that page while we reach back for another? Right to left, right to left, goes that good right arm when we are supposed to be sitting relaxed with a good magazine. Might as well be out seeding the lawn. The effort spent is the same.

Now, consider the smart method of letting the pages slip off the left thumb one by one and seeing them turn *themselves*.

When we find something interesting, what's the hurry? As another page or two float by effortlessly, we soon find out how it all starts!

Good thinking, Ralph! It may be the height of laziness, but it's good self-preservation.

E. A. Geoffroy, South Bend, Ind.

Convincing Talk

I can well see how your magazine is so popular, because when you talk about something you do the job up right.

Ralph H. Kress, General Manager
Dart Truck Co., Kansas City, Mo.

How "Lightning" Cracks Nuts

As a loyal subscriber of long standing, I have read many articles in your magazine that bordered on the incredible, but your story about the man-made lightning bolt that cracks nuts [Nov., p. 157], I believe, goes over the border.

A rapid calculation shows that 5,000 amperes at 65,000 volts is equal to 325,000

How I foxed the Navy

by Arthur Godfrey

The Navy almost scuttled me. I shudder to think of it. My crazy career could have ended right there. Who knows, I might still be bumming Chesterfields instead of selling them.

To be scuttled by the Navy you've either got to do something wrong or neglect to do something right. They've got you both ways. For my part, I neglected to finish high school.

Ordinarily, a man can get along without a high school diploma. Plenty of men have. But not in the Navy. At least not in the U. S. Navy Materiel School at Bellevue, D. C., back in 1929. In those days a bluejacket had to have a mind like Einstein's. And I didn't.

"Godfrey," said the lieutenant a few days after I'd checked in, "either you learn mathematics and learn it *fast* or out you go. I'll give you six weeks." This, I figured, was it. For a guy who had to take off his shoes to count above ten, it was an impossible assignment.

I was ready to turn in my bell-bottoms. But an ad in a magazine stopped me. Here, it said, is your chance to get special training in almost any subject—mathematics included. I hopped on it. Within a week I was enrolled with the International Correspondence Schools studying algebra, geometry and trig for all I was worth.

Came week-end liberty, I studied. Came a holiday, I studied. Came the end of the six weeks, I was top man in the class. Within six weeks I had mastered two years of high school math, thanks to the training I'd gotten.

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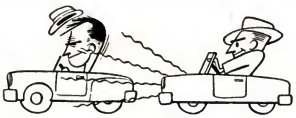
kilowatts, enough to make Grand Coulee pause for reflection. At the nominal sum of three cents per kilowatt, the power bill for cracking walnuts would be $9,750 per machine per hour, or $1,404,000 for the 18 machines for an eight-hour day!

CHARLES STEIN, Beverly Hills, Calif.

Perhaps we didn't make it sufficiently clear that the 5,000-ampere, 65,000-volt current is not continuous. It comes in flashes lasting only 50 millionths of a second each. The entire plant is fed by a modest, 60-horsepower motor-generator set, and the actual operating cost of the "lightning" walnut cracker is 55 cents an hour.

How to Shame Hornblowers

Far too many drivers are emulating Gabriel over these fair United States. I seem to recollect the occasional appearance of a



slogan "Use your brakes, not your horn." I propose a compromise.

Why not have a horn that can be operated only when the driver is preparing to meet a hazardous traffic condition or other emergency? This can be done by connecting the existing stop-light switch in series with the battery and horn. The other horn wire would go to ground via the existing method of operation.

Of course, this item would have to be supervised by state inspectors to prevent eager Casey Joneses at the throttles from bypassing the switch, but conspicuous hornblowers would give themselves away anyhow if they tried this dodge, for their stop lights wouldn't show.

FRANK H. FRY, Philadelphia.

Good for Three Hard Stops

In your article on the 1954 Chrysler [Nov., p. 99] you stated that Chrysler has decided to retain the standard brake pedal in its power braking system because, should the engine stall on a downgrade, the wheels wouldn't turn the engine fast enough through the torque converter to develop enough vacuum to work the power system. I was under the impression that power

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braking systems have vacuum reservoirs which make it possible to apply the power brakes several times after the engine has been shut off.

EDWIN G. SOLOV, Flushing, N. Y.

Most power braking systems do have a vacuum reservoir. It is good for about three hard stops. Chrysler intends its high pedal to guard against a complete failure of the system, bearing in mind the possible results of such failure on a long hill or in mountainous country.

Minority Report

The Denver traffic-control scheme that's written up so fulsomely in your September issue is fine in theory. But in practice, Denver's traffic problems are now more confusing to pedestrians and drivers alike than they ever were.

CECIL COX, Denver.

According to the Denver Post, *80 percent of the people highly approve of "the Barnes dance" and other innovations of traffic engineer Henry Barnes. And the death rate in auto accidents has been cut by more than half since he started untangling the city's vehicular snarl.*

More Backing for Road to Panama

Your article on "The Wonderful Road We Never Finished" [Jan., p. 97] points up a situation that is of great importance to the nations of Central and South America, as well as to our own country.

The Inter-American Highway, by facilitating inter-American travel and communication, should further friendly relations

between the nations of the Americas. It should also demonstrate to the nations of Central and South America the part that an adequate transportation system can play in developing their natural resources.

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— *Good looking—but* not *too handsome*	(20 points)
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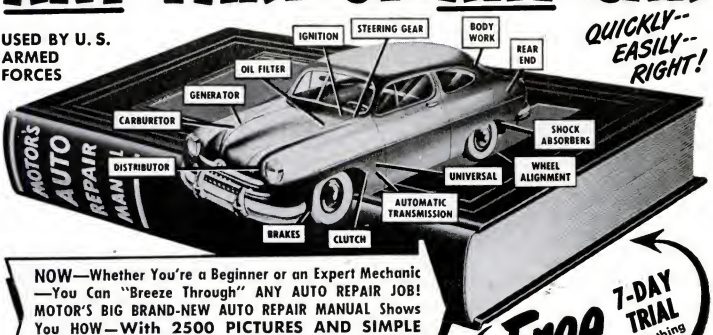

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sources and the attainment of a higher standard of living for its people are dependent to a large degree upon the improvement of their transportation facilities.

Means to move raw materials to production centers will materially assist in building up production facilities, and efficient production, either industrial or agricultural, will need practical means of getting the product to market. A nation's transportation system can help greatly its economic development.

The Inter-American Highway should show the need for additional roads in these countries, and encourage the development of other means of transportation necessary to their growth.

NICHOLAS KELLEY, JR., Secretary
Chrysler Corp., Detroit.

Too Fast to Be True

In your article "World's Greatest Speedboat" [Oct., p. 104] you state that *Slo-mo-shun IV* holds the world's straightaway speed record. That's fine and dandy, but you also said that the record speed was 187.6 m.p.h. The 1953 *Information Please Almanac* says the speed is 178.497 m.p.h. Is the *Almanac* wrong?

CHARLES WHITAKER, Melvindale, Mich.

No, we were.

Fastest Clipper Ship

I have in front of me the issue of PSM for December, in which an article by Winthrop Pratt Jr. appears. It is entitled, "How to Build the World's Fastest Clipper Ship."

I take it that Mr. Pratt has never heard of the *Cutty Sark*, so here is a little general information about her: Built by Scott & Linton, Dumbarton, Scotland, in 1869; length, 212½ ft.; breadth, 36 ft.; depth, 21 ft.; weight, 963 tons gross, 921 tons net, ship rigged. While easting off the Cape she made 17½ knots under Capt. G. Movdie. The top speed recorded for the *Sovereign of the Seas* was 16½ knots.

How about a little credit where credit is due?

R. J. DIXON, Port Arthur, Canada.

We are glad to credit the Cutty Sark *with the record for top speed. The* Sovereign's *claim to the title of "world's fastest clipper ship," as our article noted, was based on a run of 3,562 miles in 11 days—which was also a record.*

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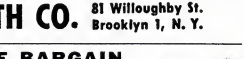

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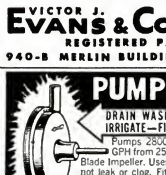

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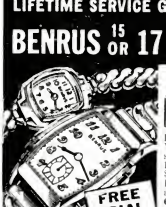

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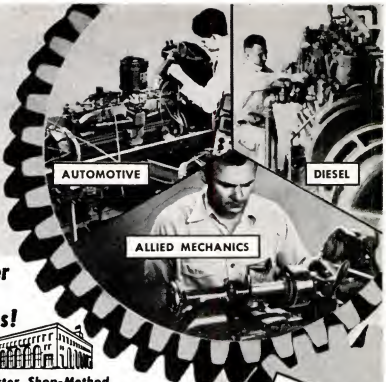

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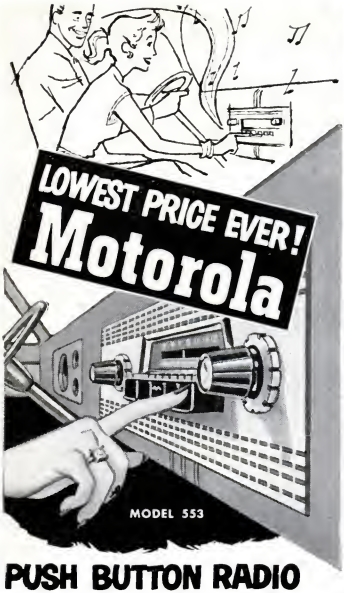

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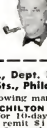

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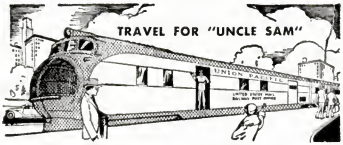

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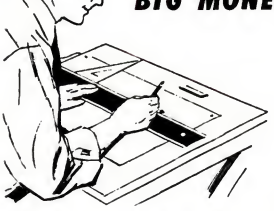

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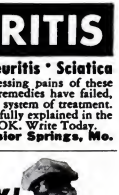

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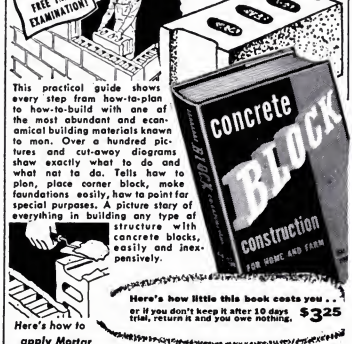

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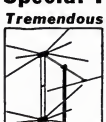

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Master a trade with a future—learn Auto-Diesel mechanics in our shops. You learn with tools on real equipment. Earn while you learn. Many of our graduates earn $100 per week and up. No previous experience necessary. Day and night courses. Approved for veterans. Write for free bulletin.

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Sizes 6 to 16

Men with narrow feet! Enjoy a perfect fit at no extra cost. We specialize in narrow widths only. AAA to B, sizes 6 to 16. Write TODAY for FREE information about wide style variety.

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No matter where you live or what you are doing now . . .

I WILL TRAIN YOU FOR A BIG PAY JOB IN TELEVISION

L. C. Lane, B.S., M.A.
President: Radio-Television Training Association.
Executive Director: Pierce School of Radio-Television.

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Thousands of new jobs in TV are opening up in every state as new stations go on the air. You too can take your piece in America's booming TELEVISION and Electronics industry . . . enjoy the success and happiness you always wanted out of life! Now . . . prepare for a life-time career as a trained TV TECHNICIAN, often within months . . . using the same successful "learn-by-doing" home study methods that have helped hundreds of men with NO PREVIOUS TRAINING!

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LEARN TELEVISION AT HOME IN YOUR SPARE TIME!

Giant Screen TV Receiver

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GET MORE! LEARN MORE! EARN MORE!

I give you ALL the equipment and training you need to prepare for the BETTER PAY jobs in TV. While training, many of my students make $25.00 a week repairing Radio-TV sets in their spare time . . . start their own profitable service business.

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You build and keep this professional GIANT SCREEN TV RECEIVER complete with big picture tube (designed and engineered to take any size up to 21-inch). Also all units illustrated, plus additional equipment! Everything supplied complete with all tubes.

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NEW! PRACTICAL TV CAMERAMAN & STUDIO COURSE!

For Men With Previous Radio & TV Training

I train you at home for an exciting big pay job as the man behind the TV camera. Work with TV stars in TV studios or "on location" at remote pick-ups! A special one-week course of practical work on TV studio equipment at Pierce School of Radio & TV, our associate resident school in New York City, is offered upon your graduation.

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My FM-TV Technician Course will save you months of training, if you have previous Armed Forces or civilian radio experience. Complete with kits, BIG SCREEN TV RECEIVER, and FREE FCC Coaching Course.

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52 EAST 19th STREET, NEW YORK 3, N. Y.
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Dear Mr. Lane: Mail me your NEW FREE BOOK, FREE SAMPLE LESSON, and FREE aids that will show me how I can make BIG MONEY IN TELEVISION. I understand I am under no obligation and no salesman will call.

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3 Conditions that hinder the CONTINUED GROWTH of HAIR

1 FALLING HAIR 2 ITCHING SCALP 3 DANDRUFF SCALE

Thousands have found blessed relief and amazing results with

HARE-ON HAIR FORMULA WITH LANOLIN

This exclusive formula was developed for use by both men and women who suffer with itching scalp, dandruff scale or falling hair. Scientists agree that hair will continue to grow as long as the hair follicle is undamaged and a normal, healthy blood supply to the scalp is maintained. We believe the hair follicles of many bald or partially bald people are alive even though no hair is growing from them.

BEFORE AFTER

BOB STEPHENS, Rockville Centre, N. Y., writes: "I have used HARE-ON for 6 months and am still using it. I recommend this formula for any male or female of any age suffering from heavy scale of dandruff and excessive loss of hair. You'll witness a miracle like I did, as a result a good thick head of hair, thanks to HARE-ON."

BEFORE AFTER

IRVING SCHWARTZ, Long Beach, N. Y., says: "My bald spot was spreading relentlessly in spite of all efforts to stop it until I started using the HARE-ON Home Treatment Course. Results were noticeable after only a few weeks of easy self-treatment with HARE-ON and now I again have a good healthy head of hair."

(Photos are warranted unretouched prints of original negatives made by a reputable professional photographer. Photographer's name and street addresses of users on request.)

HARE-ON WITH LANOLIN HOME TREATMENT COURSE

is sincerely recommended as a simple, effective method of obtaining relief from the tortures of itching scalp, unsightly dandruff scale and falling hair that afflicts both men and women. It contains no water or alcohol.

The makers of HARE-ON do not classify their exclusive formula as a so-called "hair grower." They do not guarantee that it will grow new hair, in fact, not every user has reported renewed hair growth. The use of HARE-ON Home Treatment Method as directed is designed to restore the scalp blood supply. By thus discouraging the common causes of hair loss it helps the scalp to function "freely in promoting the growth of hair.

LESS THAN 25c A TREATMENT!

The HARE-ON Home Treatment Course is easy to use. Apply this exclusive formula yourself, simple directions with each package. No mess, no bother, no odor! Inexpensive to use! Generous supply of HARE-ON more than enough for 8 Weeks Home Treatment Course for only $10, plus $2 Federal Tax, **actually less than 25c a treatment!**

NO-RISK GUARANTEE

HARE-ON (Hair Formula with LANOLIN) is guaranteed harmless and may be used beneficially by every member of the family. If for any reason, you are not satisfied with HARE-ON, simply return the unused portion and ENTIRE PURCHASE PRICE WILL BE REFUNDED.

PROVE IT TO YOURSELF NOW!

Why suffer longer? *You will thank us for the rest of your life!*

MAIL COUPON TODAY!

HARE-ON CORP. PS 254
P.O. Box 474, Hempstead, N. Y.

Please send me—in plain wrapper—8 weeks HARE-ON (Hair Formula with LANOLIN) Home Treatment Course with simple DIRECTIONS for use. If not satisfied I will return unused portion for FULL CASH REFUND.

☐ SEND PREPAID. I enclose $10 plus $2 Fed. Tax—TOTAL $12. Use Check or money order. We pay postage.

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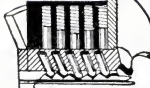

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TASOPE DEPT. PS-2, AURORA, MO.

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When kidney function slows down, many folks complain of nagging backache, headaches, dizziness and loss of pep and energy. Don't suffer restless nights with these discomforts if reduced kidney function is getting you down—due to such common causes as stress and strain, over-exertion or exposure to cold. Minor bladder irritations due to cold or wrong diet may cause getting up nights or frequent passages.

Don't neglect your kidneys if these conditions bother you. Try Doan's Pills—a mild diuretic. Used successfully by millions for over 50 years. It's amazing how many times Doan's give happy relief from these discomforts—help the 15 miles of kidney tubes and filters flush out waste. Get Doan's Pills today!

I have a good proposition for men or women who would like to make an extra $125.00 a month for spare time

These 15 Utensils and covers are all interchangeable. They fit into each other so as to make up 23 different cooking combinations for "Waterless Cooking." The four egg cups make a 19-piece set that covers 99% of all cooking needs.

By Frank W. Strong

I won't make any fancy promises of $50.00 a day. And I'm not after any of your money. What I can do is show you a simple plan by which you can pick up enough extra money every week to help make up for the money you're losing in higher taxes and higher costs of living. And I supply your working outfit free—no charge and no deposit. Just your name is all I need. Read my proposition. It is honest and down to earth. And it won't cost you anything to try it.

TODAY almost everyone needs extra money. Increased taxes and increased living costs are making your dollar worth less and less, so you have to have more and more dollars just to keep even. There are lots of good ways to make extra money. I don't say my way is the best. I do say it's one of the easiest and most pleasant. It even leads to making new friends. It doesn't call for house-to-house canvassing, either. Let me explain:

I am Sales Manager for a very big manufacturing company. We make Stainless Steel Cooking Utensils. We do an enormous business with hotels, restaurants, hospitals, and institutions. We also make utensils for the Army, Navy and Air Force.

As a result, we have very low manufacturing costs. We can **sell** a set of Stainless Steel Cookware for home use for about what it costs some companies **to make it!** In fact, for years we did sell to one Sales Organization who resold our cookware house to house under their own name. They got $120.00 for the same set that our people sell for approximately half of that.

You've probably heard of salesmen who give dinner parties in homes and then take orders from the ladies who attend. These salesmen have to get a high price because it costs money to give parties—he has to make his share—and his supervisor has to make his. The sales organization adds a profit and the manufacturer has to make his. So there are about four or five profits added to the actual manufacturing cost.

About two years ago I got to figuring. There are five good reasons why Stainless Steel is the kind of cookware that should be in every home. 1. It washes as easy as a drinking glass. No scouring, scraping or scrubbing. 2. It doesn't rust or corrode—and it doesn't stain. 3. It doesn't affect the taste of food. 4. Carlton Ware enables you to prepare food by the method called "waterless cooking" which keeps more of the natural minerals and vitamins in your food and makes the food taste better. 5. Buy it once and you're all through buying for life. You **can't** wear it out.

You see, Stainless Steel is not a coated or plated metal, like chromium plate on the bumper of your car. That chromium plate can chip or wear off and exposes the raw steel underneath. Then the steel rusts. But our kind of Stainless Steel is stainless **all the way through.** It can't chip, crack, peel, or wear off. You could use a set the rest of your lifetime and then give it to your children and it would still be good for **their** children.

Well, I figured that if the price was low enough every family could afford Stainless Steel Carlton Ware. So I worked out this plan! We would sell a complete set of 15 pieces at a figure that would include our profit. Then you add your profit and re-sell this set to your friends and neighbors for just about half of the usual price charged on the "party plan." They are glad to get such a bargain and they feel that you've done them a real favor.

The plan becomes like an endless chain. When a woman gets her first piece of Carlton Ware she gets so thrilled with its better cooking and easy cleaning that she talks and talks. She can't wait to demonstrate it to her friends and tell them all about it. She's so proud of its silvery sheen that she just "bubbles over." So just by letting **your own friends** in on a good thing, before you know it **their** friends call you up and ask if you can get the same low prices for them. Then **their** friends call you and their **friends' friends.** It goes on and on!

To make an extra $125.00 a month, you only have to deliver seven sets and that's easy. Mrs. Montell in Pennsylvania took orders for $1400.00 worth in her first month. And Mrs. William Hanchorn wrote, "Got my set Saturday—I already have 17 customers."

Now, I'll let you in on another part of my plan. If you take only ten set orders a month for six months my company pays your expenses for a winter vacation in Florida. We maintain a beautiful resort in the Florida Keys just so our sales representatives can enjoy a Florida vacation at company expense.

Get all the information right now. I'll not only be glad to send Free Information, I'll also send you a complete demonstrating outfit that you can show to your friends and neighbors. And I'll give you exact instructions by which you can write up orders without ever trying to "sell" and without making any house-to-house calls.

Everything I send you is free. When you qualify, I'll even furnish you with a complete 15-piece set of Carlton Ware to use in your own kitchen and show to your friends. It's an extra bonus I give to encourage good earnings on your part.

Send your name today in confidence. You'll be glad you wrote. This ad may not appear in this magazine again, so don't take any chances on losing out. Send the coupon or just send your name on a postcard. I won't send any salesmen to call on you and you won't be under the slightest obligation.

Frank W. Strong

Carlton of Carrollton, 2742 High St., Carrollton, Ohio

Frank W. Strong, Carlton of Carrollton
2742 High St., Carrollton, Ohio

Dear Mr. Strong: Please send me free and without any obligation a complete selling and demonstrating outfit with exact instructions for making an extra $125 a month. I don't want to do any house-to-house selling, but I will show your products to my friends and give them the advantage of the low prices.

Name .....

Address .....

City..... *Zone*....*State*.....

☐ I am already selling Cookware and am interested in getting a line that can be sold at a lower price. Please send me your Distributor's proposition.

FREE!

SAMPLE OF FLOK-KRAFT Suede Paint

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FLOK-KRAFTERS needed in every City, Town or Village...

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—NELS IRWIN
Director of Instruction

FIND OUT at NO RISK How to BECOME A FLOK-KRAFT EXPERT... MAKE $5 to $10. PER HOUR AND MORE AT HOME!

I have made arrangements for you to examine the complete Flok-Kraft instructions and starting kit, including the High Velocity Spray-Gun — at absolutely no risk. Read the instructions in the privacy of your own home. Apply Flok-Kraft finish to an item of your own choice and see for yourself what Flok-Kraft can do for you.

PROFESSIONAL SECRETS CAN BE YOURS. At last, secrets of this amazing miracle finish can be yours! Huge profits waiting to be tapped in tremendous new field. Flok-Kraft gives a velvety, luxurious surface to radios, lamps, toys, signs, store displays, figurines, auto dashboards—**A THOUSAND AND ONE ITEMS TO BE SEEN ON EVERY HAND EASILY AND QUICKLY BEAUTIFIED,** enriched, increased in value with Flok-Kraft. Make old objects beautiful—saleable, make new things worth much more with this soft, rich covering that can be applied to any surface, even if old or worn.

YOU CAN LEARN IN A FEW DAYS. Fully detailed Flok-Kraft Instructions—complete and easy to understand—every point explained—shows you how to start on the road to big money, full or spare time, right away.

WE FURNISH EVERYTHING YOU NEED TO START. You also get complete Flok-Kraft kit of materials and equipment that enables you to start at once. Add to your income from your regular job or begin to build a successful business of your own and do it all, right in a corner of your basement, garage, service porch, kitchen or living-room.

GRASP THIS LIFETIME OPPORTUNITY TODAY. I'll arrange to send you the complete outfit—everything you need to start—for leisurely, no-risk examination right in your own home. You owe it to yourself to investigate. **FILL OUT AND MAIL THE COUPON NOW** for **FREE** Sample, Plan, etc. Do it today! Everything I send you now is **FREE OF CHARGE, POSTPAID.** Airmail's faster.

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Gentlemen: I want to see for myself the miracle of Flok-Kraft. Please rush me FREE sample and complete home profit plan. I understand that I'll be under no obligation of any kind.

Name _____
Address _____
City _____ Zone _____ State _____

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If you have trouble with plates that slip, rock and cause sore gums—try Brimms Plasti-Liner. One application makes plates fit *snugly without powder or paste,* because Brimms Plasti-Liner hardens permanently to your plate. It relines and refits loose plates in a way no powder or paste can do. Even on old rubber plates you get good results six months to a year or longer. **YOU CAN EAT ANYTHING!** Simply lay soft strip of Plasti-Liner on troublesome upper or lower. Bite and it molds perfectly. *Easy to use,* tasteless, odorless, harmless to you and your plates. Removable as directed. Plate cleaner included. Money back if not completely satisfied. If not available at your drug store, send $1.25 for reliner for 1 plate.

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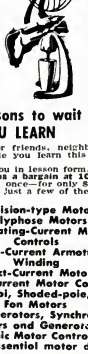
. . . for only $6 FOR THE COMPLETE TRAINING



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Every day, more and more electric motors and motor control systems are being used BOTH in industry and in home appliances. The expert who can install and keep them working properly is a valuable man in this Electrical Age. The pay is surprisingly good. The field is tremendous—and growing rapidly. Trained men find opportunities everywhere for full or part time work. ELECTRIC MOTOR REPAIR, the big 560-page training course book teaches you the work step by step—quickly and easily—at home in spare time. There is no other book like it. Ideal for beginners or for actual bench use in busy shops. Thousands already in use in leading vocational schools, shops, and for home study.

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A unique Study Guide booklet of 500 practical motor study questions—priced and sold separately at 25c—is yours FREE with your request to examine ELECTRIC MOTOR REPAIR book. Makes learning easier—speeds up the work! See coupon.

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Practice by repairing motors for friends, neighbors or nearby business houses. Earn while you learn this profitable, fast-growing business!

If sold as a course and sent to you in lesson form, you'd regard ELECTRIC MOTOR REPAIR **as a bargain at 10 times the price!** Instead, you get it all at once—for only $6. You learn fast . . . and right. Here are just a few of the motor types that are fully covered:

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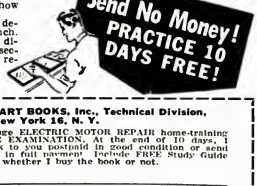

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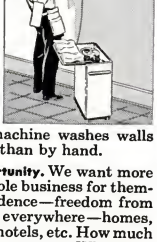

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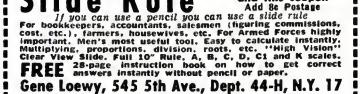

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650-16(6)	7.15	710-15	5.35	750-17	10.85	825-20	17.75
700-16	6.25	760-15	5.85	700-20	11.85	900-20	17.85
750-16(6)	8.35	800-15	6.25	825-15	11.05	1000-20	16.85
550-18	4.85	820-15	6.25	600-20	8.25	1100-20	17.85
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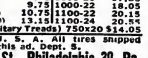

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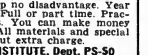

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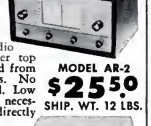

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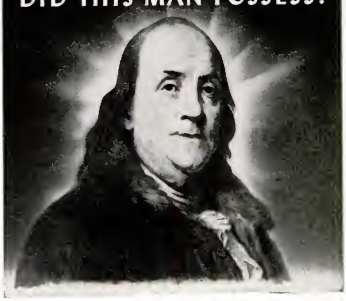

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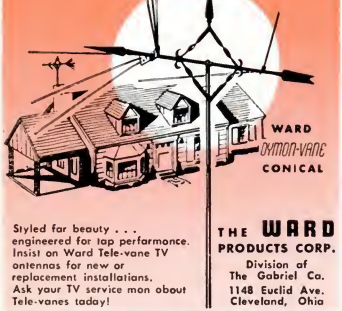

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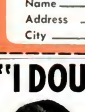

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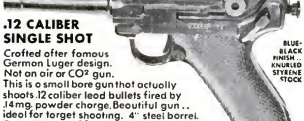

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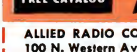

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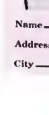

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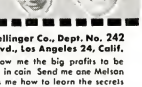

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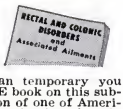

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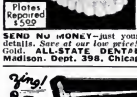

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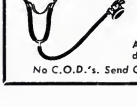

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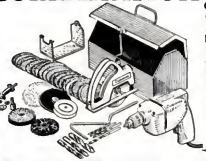

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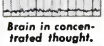

Brain in concentrated thought.

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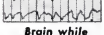

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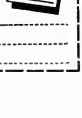

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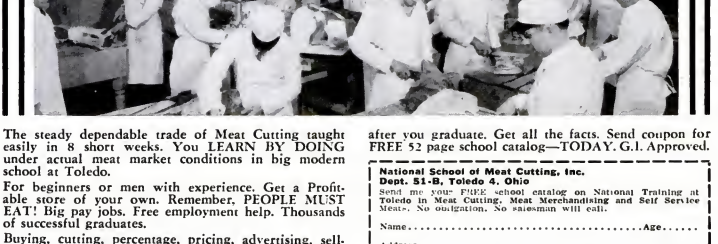

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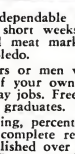

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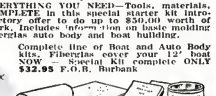

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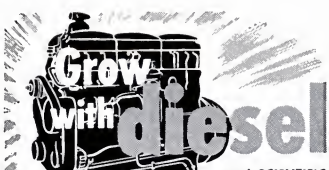

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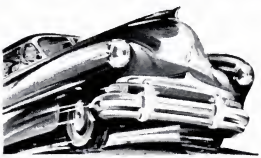

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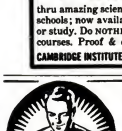

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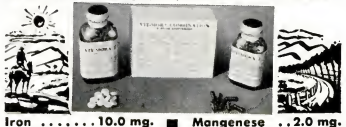

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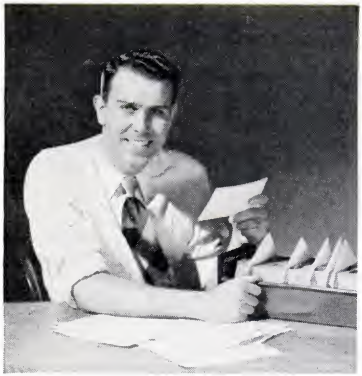

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EARN $2.00 Hour! I do—making Sandals. Young. 1308-PS South First, Arcadia, California.

PLASTERCRAFT molds, liquid rubber, plaster, flocks, candle supplies. Catalog and manual free. Jayhawk Plasters, Blue Rapids, Kansas.

MAILORDER Beginners 25c Bargain Guide 10c. Terrill, Bogard 2, Missouri.

FREE! Mail order book! Ramshead Publications, Gibbsboro 5, New Jersey.

START home mailorder business. Details—Gedgard, Box 798-H, New York 1, New York.

UNUSUAL homework opportunity. Spinning angora for us. Men, women, spare-time. Angora House, PSM, Springfield, Ill.

NATURAL molding rubber, extra thick. Free sample. Flock, tinsel candle wax. W. Wooley 1-B Donald, Peoria, Illinois.

BUY it wholesale. Manufacturers. Distributors. Over 850,000 items. Literature free. Olsen, 1231-B East Third St., Duluth 5. Minnesota.

NEED capital? I'll tell you how and where to get it. Write, Dougherty, Box 88K, Van Nuys, Calif.

EARN money! Amazing plans! Easily mastered Details. Bruns, 216-E West Jackson. Chicago 6. Illinois.

START your own profitable home mail-order business! We supply everything! Write today! Studio Products, Box 56-"D" Glendale 5. California.

START a lettershop on a shoestring! Sales $56,000. Started $36.00. Information? Wells, Box 13, Basking Ridge, New Jersey.

FIBERGLASS Wonder material for boats, auto bodies, etc. New field opening. Earn while you learn. Generous practice kit and instruction manual $4.95. Manual only $1.00. U.S. Fiberglass-Resin Co., 722-A East Washington, Los Angeles 21, California.

DON'T Anyone Pass This Ad up! New inventions with staggering public acceptance, mountainous profits. Three demonstrators worth up to $14,98. Everyone write "Research Engineering", 1209 Orange Avenue, Philadelphia 48, Pa.

LEARN metalizing baby shoes, gifts, etc. Bronze, gold, silver. Folio Free. Kikitat, 7217-PS South Broadway, Los Angeles 3.

$46 FROM Square Foot Plywood; Jigsaw necessary. Write: Woodart, Bridgewater, Mass.

START Venetian Blind Laundry. Profitable lifetime business. New machine. Free booklet. F.D. Co., 442 N. Seneca, Wichita 12, Kansas.

DOLLARS in the mail for you! Put your ad here and watch orders fill your mailbox. For as little as $9.00, you can advertise your product or service in the classified opportunities columns of Popular Science Monthly. The April issue closes on February 23rd. Write today for order blank and free copy of booklet "How To Make Money Out Of Classified Advertising". O. K. Kelly, Classified Adv. Mgr., Dept. 254, Popular Science Monthly, 352 Fourth Ave., New York 10, N. Y.

38 MONEYMAKING OPPORTUNITIES

SELL Titania gems; $9.75 carat wholesale. More brilliant than Diamonds. Free catalogue. Diamonite, 1404-S Mitchell, Oakland 1, Calif.

SPARETIME Profits Taking Subscriptions. All Magazines. Wholesale Catalog Free. Cassell Agency, Westfield 2, N. J.

DETECTIVES Earn Big Money. Experience unnecessary. Detective Particulars free. Wagoner, P-125 West 86th, N. Y. 24.

SCHOOL Seniors—Sell Classmates America's most beautiful Graduation Name Cards. Largest selection. Highest commission. Outsells all others. Free sample kit. Printcraft, Dept. P, 1509 Maple St., Scranton 5, Penna.

MAKE Money addressing Envelopes! Our information reveals how. Only 30c. Business, Dept. 46-B, P. O. Box 2224, St. Louis, Missouri.

MAKE Money—At home by mail. Fast, Easy. Liebig Industries, Beaver Dam 2, Wisconsin.

$10,800 PROFITS! Your Own Mailorder Business! No risk! "Success Plan" Free! Treasury, 709 Webster, New Rochelle PS-20, New York.

ADDRESS advertising postcards. Must have good handwriting. Lindo, Watertown, Mass.

NEW Plastic Mending Tape. Just press on! Repairs clothing instantly. Lightning seller. Samples sent on trial. Kristee 100, Akron, Ohio.

NEED More Money To Live On? Increase your weekly income $20 to $25 or more in spare time. Supply Rawleigh Products to Consumers. Also openings for full time Dealers. Write Rawleigh's, Dept. B-DD-PSC, Freeport, Illinois.

1930 DEPRESSION forced me to invest my own business—a minimum-cost, high-potential home mailorder. Lucky design paid immediately, over $1,000 every month since! Over half net! This original design, "Selective Mailorder," is United States Postal Service approved. Now mapped out to guide new mailorder operators. Literature free. Eveningshade Ranch, Helotes 15, Texas.

MINIATURE Trees—Why pay $2.00—$10.00 for growing secrets? Free Details. Bassett, Dept. P, 5038 N. Winthrop, Chicago 40.

$500,000 BY mail from home. Free Folder. Publicity, Kalamazoo 65EH, Mich.

BUY Wholesale—Thousands Nationally advertised items. Save—Make Money! Free Details. Durex Co., Box 672-P, Chicago 90, Illinois

MAKE Money at home. Everything furnished. Complete with $2.00. Free literature. Jackson, Box 21, Alhambra, Calif.

MAIL order pays dollars. Start now. Chest, Box 7252, Tampa, Florida.

CASH or credit buys guaranteed nationally advertised merchandise at absolute wholesale prices, inquiries invited. Leopold's, Box 1113-P, Columbus 16, Ohio.

SPARE Time Money plus New Car as encouragement bonus. Amazing 60 denier nylons 3 pairs guaranteed 3 months. Write Wilknit, 2042 Wash., Greenfield, Ohio.

INTERESTING big mail 25c. Selmart, Box 29, Soundview Station, New York 72.

PLEASANT spare time research work. RTK, Box 6693, Cleveland 1, Ohio.

START A Buying Service, buy wholesale thousands nationally advertised products. Make big profits selling at sizeable discounts. Postcard brings details. American Buyers, 636-S Linden, Buffalo, N. Y.

400 RADIO Stations active. Free radio advertising. Pay commission only on orders received. Free information. Mishek, 1, Wasecs, Minn.

OWN Operate Route—"Wishing Wells." Place these New $8.50 Skill Games on counters in Cafes, Clubs, Luncheonettes, etc.—collect coins weekly. Write "Leatshero" Box 929, Long Beach 1, California.

MAKE to $4.50 hour doing common pen lettering. National Artists, 801½-C North Marsalis, Dallas 3, Texas.

WANTED: Typewriter owners. Make handsome profits. Write today. Groves Company, 682 Hastings 3, Nebraska.

WIN contest money. General Contest Bulletin gives hundreds of tips. Lists current contests and rules. Sample 25c General Contests, 1609-A East 5th, Duluth, Minnesota.

EARN Money Evenings, copying and duplicating comic cartoons for advertisers. Adservice, Argyle 2, Wisconsin.

FREE! "301 Profitable Small Businesses!" Amazing shoestring plans! Work Home! Start Spare time! Dermant Surveys, Kenmore 22-T, New York.

EARN $50-$100 Weekly operating Home Mail Business. Write, Lewis Bartlett, Richland, Georgia.

PROVEN Successful Home Work Offers. Darnell, Box 586, Jackson, Tennessee.

WEEKLY extra income mailing circulars for advertisers. Enterprise, 2121 Sanford, Mattapan 26, Mass.

GROW Mushrooms. Cellar, shed, and outdoors. Spare, full time, year round. We pay $3.50 lb. We paid Babbitt $4,165.00 in few weeks. Free Book. Washington Mushroom Ind., Dept. 119, 2954 Admiral Way, Seattle, Washington.

FREE Book "505 Odd Successful Businesses." Work Home! Expect something Odd! Pacific-35C, Oceanside, Calif.

MANUFACTURE Rhinestone and Pearl Jewelry at home. Latest creations, tremendous profits, no skill needed. Postcard brings illustrated catalog of settings, stones, etc. A. V. Cutt Co., Inc., 210-B Fifth Ave., New York 10, New York.

$$$$ IN personalized baby record books. Sell by mail. Eleven thousand new prospects daily. Use same literature we do. No-Co-Ro, Oakland G-P, 22, California.

10,000% PROFIT! Details free! Douglas Service, Box 675, Oak Terrace, Minn.

ADDRESS envelopes at home. $25 weekly possible, sparetime. No selling. Write, Temple Co., Box 946, Muncie 7, Indiana.

EARN Money—Mailing magazines etc. Pleasant homework, samples, details 25c. Rorick, Columbus 15, Ohio.

BUY printing and office supplies wholesale. 10,000 items. Literature free. Royal, Box 368-S, Cleveland 27, Ohio.

NATIONAL mail order house offers sensational mailing program full or part time. Suppliers Mailing, Buena Park 9, Calif.

EXTRA Money Every Week. I'll send you full-size Bijur household products. Show them to friends and neighbors. You can make Big Extra Profits. Write Blair, Dept. 55MB-1, Lynchburg, Va.

TOP men earn $12,000 and more in a year in a profitable selling career. Call on owners and users of heavy duty equipment. Mop lubricants and other top quality specialized products provide repeat business regularly. Top earnings immediately on collection of delivery worries. Write E. J. Baker, Dept. 678, Box 676, Dayton, Ohio.

NEED Money? Make $100 weekly at home. Business of your own. 10c rushes details. Miller, 9643 Julius Ave., Downey 2, Calif.

39 FORMULAS, PLANS, ETC.

FORMULAS—All kinds. Latest products. Literature free. Kemico, Park Ridge 15, Ill.

500 MONEY Making Formulas. 25c Postpaid. Allen, Dept. P-20, Clinton, Missouri.

REAL Manufacturing Formulas. Lists Free. Cumming, Chemist, Gordon Avenue, Syracuse 4, New York.

ANY Formula $5.00. Satisfaction guaranteed. Jack, Chemist, 5138 Gainor, Philadelphia 31.

FREE Formula Catalog. Anything analyzed $5.00. Pesterson Chemical, Salem, Ore.

MILLER'S modern manufacturing formulas make fast selling products that get the business and pay! Fifty years supplying the trade. Last literature free! Lincomb Miller, chemist, Tampa, Florida.

ANY Formula $3.00. Catalog—Chemical Instruction sheet 10c. J. Belfort, 192 N. Clark, Rm. 620, Chicago 1.

LABORATORY Tested Formulas. Catalog free. Pont Chemical Company, Terre Haute 1, Indiana.

OUR laboratory tested formulas and know-how put you in business. Free information, write Stark Co., Grafton, Wisc.

40 PLASTICS

PLASTICS home-craft course for Men and Women. Tells and shows how to make hundreds of fast selling plastic products. All plastics and materials for 23 projects included in course. No special tools needed. Course pays for itself. Write for Free booklet. Interstate Training Service, Dept. D2-B, Portland 13, Oregon.

PLEXIGLAS Lucite. Any size sheets. Square root (12x12) cost, 1/16", $1.18; ⅛", $1.55; 3/16", $1.90; ¼", $2.25. Add 15% for postage. Minimum order $3.00. Almac Plastics, 600 Broadway, New York City.

PLEXIGLAS sheets—cut to size—clear, all thicknesses—standard outdoor transparent colors. McClarin Plastics, P.O. Box 168B, Hanover, Pa.

LEARN Plastics at home. Complete kit—$5.98 postpaid. Dime brings sample plastic, three experiments, full details. Plastic Projects, Box 5151, Detroit 35, Mich.

NEW liquid casting plastic. Clear, colors. Preserve flowers, insects, photos permanently. Saw, drill, carve. Send 25c for Castolite Casting Manual and proved Success Plan showing how to make money at home. Castolite, Dept. B-102, Woodstock, Illinois

PLASTIC Sheets, Rods, Tubes; etc. Free List. Plastic Supply Co., 2901 N. Grand Blvd., St. Louis 7, Mo.

PLASTICS—Cements—Dyes—Findings—Carvings. Wholesale prices. 64 page catalog free. "Trace & Carve" pattern book for carving and coloring fish, birds, animals, only 35c. Taylor & Art, Inc., 1710 East 12th St., Oakland 6, California.

FIBERGLAS, Polyester, Plexiglas, Acetate, Vinylite; Casting, coating plastics: Maurice Lannon's Fiberglass "How" book now ready—$2.50. Fast service, best prices. Catalog—10c. Airmailed—35c. Gem-Lite, Box 6868P, North Hollywood, Calif.

41 CHEMICALS & APPARATUS

ILLUSTRATED Catalog: Chemistry, mineralogy, biology 20c. Tracey Laboratories, Evanston, Illinois.

SPECTROSCOPE for quick chemical analysis $3.00. Cutting Sons, Los Altos, California.

NEW Idea Chemical and Apparatus Outfits for Home Experimenting Photo-Scales, Microscopes, Chemicals, Biological and Laboratory. Supplies in Small Quantities. Catalog 25c. Established 1931. John H. Winn, 124-B West 23rd Street, New York, N. Y.

CHEMISTRY for all ages. Painstakingly prepared course for people denied classroom training. Brand new, Absorbingly interesting. Truly worth-while. Includes free membership in Future Chemists of America and bi-monthly bulletin. Member participation. You will like it! First lesson 25c. Parkway Laboratory, 1004f Second Ave., Pittsburgh 19, Pa.

CHEMICALS and apparatus for industrial, analytical and private laboratories. Catalog 25c. Dept. M-26, Biological Supply Co., 1179 Mt. Hope Ave., Rochester 20, N.Y.

COMPLETE Catalog, Bargain Lists 20c. Laboratory Sales, Box 161B, Brighton, Mass.

LABORATORY chemicals, research-experiment. List sent, Hooper Chemical Corporation, Box 313, Rutherford, New Jersey.

AMAZING New Book of Science, Experiments, Formulas and catalogue of Laboratory Supplies. Only 25c. National Scientific Co., Dept. 15, 2204 W. North Ave., Chicago 47, Illinois.

AMAZING new analytical ion exchange column for difficult chemical separations. Complete Kit, instructions, $4.00. Rainaway Chemical Company, 800 Delaware, Berkeley 9, California.

42 HELP WANTED

FOREIGN Employment Construction Work. If interested in foreign projects with high pay, write Foreign Service Bureau, (Dept. P S.), Metuchen, New Jersey.

FOREIGN & Latin American Employment 1954 "Foreign Service Directory" gives Up-To-Minute Facts on Military & Civilian Construction, Government Jobs, Major Oil Listings, Aviation, Transportation, Steamship Lines, Mining, Importers, Exporters. How-When-Where to apply application forms. Hot List Firms Hiring. $1.00 postpaid. Global Reports, Box 883-S, Hollywood 28, Calif.

$1900 to $4500 paid for Truck Drivers, Carpenters, Doctors, Laborers, Foreign & Domestic Jobs. Fare Paid, South America, Alaska, Africa, Far East, etc. Latest information. Spain job. Big statistical job. 25,000 Men & Women needed. Skilled & Unskilled trades, office, etc. Many jobs in Foreign lands. Send for details. How-When-Where to apply. Foreign Job Service, Waseca, Minn.

ADDRESS advertising postcards. Must have good handwriting. Lindo, Watertown, Mass.

FOREIGN Job News and Domestic. Send $1.00 for World Wide Construction Projects. How-When-Where to apply. Global Reports Monthly. Box 883-Sx, Hollywood 28, Calif.

ALASKA!! Last American Frontier. $1.00 brings 1954 Business Directory & Government Map. Alaska Civilian Construction; Homestead & Highway facts; Mining, Aviation, Fur Farming, Grazing, Timber. Travel directions. Lists of firms hiring. How to apply. Alaska Opportunist, Box 92-S, Hollywood 28, Calif.

JOBS on ships and yachts, excellent pay. Foreign Travel, Davenport's, Dept. 4, Box 1354, GPO, New York 1, N. Y.

CALIFORNIA Jobs. California's population increasing over 400,000 a year-become part of it. Have a job waiting your arrival. Complete listings, information, $1.00. Satisfaction guaranteed. Midcentury, Box 11461, Los Angeles 48, California.

DETROIT Help Wanted Columns Airmailed $1.00. Scheuern, 61 North Avenue, Highland Park 3, Michigan.

CALIFORNIA — Land of opportunity. Complete monthly employment publication including applications and housing information. $1. Pfleiderer, Box 3065, Inglewood 2, California.

HELP wanted in healthful wealthy San Joaquin Valley. Current job listings airmailed. $1.00. Riedinger's, 1101 Vagedes, Fresno, California.

HONOLULU Help Wanted columns airmailed $1.00. Pomeroy's, #3 Campbell Block, Honolulu, Hawaii.

ALASKA Job List. High Wages. Labor $3.27 hr. Plumbers $4.90. Truck Drivers $3.37, Carpenters $3.34, etc. Homestead & Alaskan Highway Map and Directions. Application Blank with Job List $1.00 postpaid (COD $1.87). Alaskan Jobservice, Waseca, M'

JOBS — United States and Overseas. Men needed now. Many average $1250.00 monthly. Construction, Trades, Professions, Clerical, etc. Includes application form, and one year registration and advisory service. Money back guarantee if we don't find you a job. Postpaid $1.00, or C.O.D. plus postage. Associated Services, Box 58-RS, Al'on, Illinois.

MEN Earn $1,500.00 per month on Foreign projects. Best Jobs in Europe, Latin America and Far North Projects. Truck drivers, $3.55 hour. Laborers, $3.00 hour. Electricians, $4.00 hour. Carpenters, $3.70 hour. Clerks, $3.00 hour. Most all trades wanted. Up to 70 hour week with time and one half. Free air cover. Transportation paid. 8 to 24 month contract. New treaty with Spain. South Korea will start new jobs as once Korea in on start. Full information of all Firms hiring, living conditions, family accommodation, wages hours, age, contract requirements, application form also latest issue of our monthly bulletin listing new contracts and coupon worth $1.00 on subscription. All for $1.00. Air Mail $1.24. Edward O. Burns, 911 N. Lancaster Avenue, Dept. 30, Dallas 3, Texas.

$1300 MONTHLY for truck drivers, $1400.00 monthly for carpenters, electricians, plumbers, etc. Includes $1200.00 for clerks and laborers. Replacement hiring now being done. Full information and complete foreign listing with current information on Spain job. $1.00. Women's listings, $1.00. 25,000 men and women needed for new statewide project! Complete information and other domestic listings, $1.00. Dept. 4-B, Opportunities Unlimited, 1110 Commerce Bldg., St. Paul, Minn.

GOLDEN California—Men needed. Thousands of openings. Jobs to $5,000 per year unskilled. $8,000.00 year skilled. Act Now! Send $1.00!. California Job Opportunities, Box 870-J, Los Angeles 53, California.

SOUTHERN California job-seeking information. $1.00. Elliott, Box 1142, Los Angeles 47, Calif.

INTERNATIONAL reports on who to contact for highest paying jobs in 28 countries. Including United States, Spain, Alaska, South America, Middle East. Listings of employers with contracts who hire skilled unskilled, professional, supervisory clerical, laborers, trades, and many others. Many average $1000.00 monthly. Also best oil and aviation opportunities. Only $2. including one year registration and advisory service. Also application blanks. We can help you find employment. The only company that guarantees complete satisfaction or your money back. International Reporter, Box 1047-S, St. Louis 1, Missouri.

FOREIGN Latin American domestic employment. 1954 "Foreign Service Directory" originator of job news by copyright, gives up-to-minute facts on military and civilian construction; Canadian, Alaskan construction; major oil companies; aviation; manufacturers; steamship lines; mining; importers-exporters; how-when-where to apply with application form. Free hot list firms hiring. $1.00 postpaid. Global Reports, Box 883-S, Hollywood 28, Calif.

NEW York City help wanted ads $1.00 per classification. Fairland Co., 233 East 165th Street, New York 56.

SOUTHERN California is booming! If you are interested in learning about Job openings, Business Opportunities, actual companies now hiring, pay scales, living conditions, etc., in this fabulous area, write Tower Distributors, Dept. 303, 15136 Vermont, Paramount, Calif.

DOLLARS in the mail for you! Put your ad here and watch orders fill your mailbox. For as little as $9.00, you can advertise your product or service in the classified opportunities columns of Popular Science Monthly. The April issue closes on February 23rd. Write today for order blank and free copy of booklet "How To Make Money Out Of Classified Advertising". G. K. Reilly, Classified Adv. Mgr., Dept. 254, Popular Science Monthly, 353 Fourth Ave., New York 10, N. Y.

43 AGENTS WANTED

START Your Own Business on credit. Your own boss. 1658 of our Dealers sold $5,000 to $27,000 in 1953. Full supply stocks, equipment on credit. 200 home necessities. Sales experience unnecessary. Pleasant, profitable business backed by world-wide industry. Write Rawleighs, Dept. B-U-PSC, Freeport, Ill.

NEW Line open in selling! Send name, address for free sales kit. Opportunity Magazine's money-making guide, listing hundreds of companies who'll pay you well, full or part-time. No experience needed. Opportunity, 28 E. Jackson, Dept. 18, Chicago 4, Illinois.

AGENTS—Big profit selling genuine gold window letters; stores and offices. Free samples. Metallic Sign Letter Co., 431-E. North Clark, Chicago.

ABSOLUTELY Free—Sales Kit. Yours for the asking. Send postcard today requesting free selling new line, belt buckles with your name or personal initials, cap badges, choice 3000 different emblems. Write Rook-Fast, Box 1425PS, Providence, R. I.

BUY Wholesale—25,000 items—Catalog 25c. Matthews, 1472-A5 Broadway, New York City 36.

ADDRESS advertising postcards. Must have good handwriting. Lindo, Watertown, Mass.

BE A Money Maker . . . Use your home as magazine headquarters. Liberal commissions. No experience—No capital needed. Everything furnished. Write for Free Catalog. McGregor Magazine Agency, Dept. 510A, Mount Morris, Illinois.

FREE—"How To Make Money with Greeting Card Books". Samples on approval. (Organizations! Ask for Fund-raising Plan.) Writewell, PS-42, Boston 15, Mass.

SELL Miracle Orlon Embroidered Work Uniforms. Looks, feels like wool; wears 3 times longer and washes like cotton. Huge 3-foot wide "Panorama" Line makes sales easy. Amazing profits. Outfit Free. Topps, Dept. 542, Rochester, Indiana.

MAKE Up To 150% Profit selling finest line Everyday Greeting Cards. New $1.00 Assortments. 21-Card boxes. Make-It-Yourself Kits, 100 fast-sellers. Extra Gift Bonuses! Assortments on approval. Stationery samples Free! Creative Cards, 2505 Cermak, Dept. 303-H, Chicago 8.

ANYONE Can Sell famous Hoover Uniforms for beauty shops, waitresses, nurses, doctors, others. All popular miracle fabrics—nylon, dacron. Exclusive styles, top quality. Big cash income now, real future. Equipment free. Hoover, Dept. B-101, New York 11, N. Y.

RUN a Spare-Time Greeting Card and Gift Shop at home. Show friends samples of our new 1954 All-Occasion Greeting Cards and Gifts. Take their orders and earn up to 100% profit. No experience necessary. Costs nothing to try. Write today for samples on approval. Regal Greetings, Dept. 97, Ferndale, Michigan.

AMAZING Discovery. Master Glaze, puts brilliant glass-like surface on cars. Free Sample. Information. Big commissions. Master Glaze, Dept. 791, 7720 Harwood, Milwaukee, Wisconsin.

MAKE Money with fast-selling Bostonian Shirts. Spare time, full time. Sales kit actual sample fabrics. Free. Bostonian, 89 Bickford, Dept. D-11, Boston 20, Mass.

POPULAR SCIENCE OPPORTUNITIES

BIG profits selling ties ($2.00 values) $6.50 dozen. Free catalog. Empire Cravats, 611 Broadway, New York 12.

RICH Opportunity for Men in their 50's. Healthful pleasant occupation, good investment needed. 150 of our men made $500 to $3.000 in one month; many just beginners. Heckman made $104 first 2 hours; Crowley made $224 first day; exceptional earnings. Openings available. (If you live in Canada write President, Dept. PS-2, 26 Industrial St., Leaside, Ontario.) In U.S.—President, Dept. PS-2, Box 711, Fort Worth 1, Texas.

NEW "Sponge" Wall Cleaner. Erases dirt like magic. Wallpaper, painted walls, ceilings. Saves redecorating. Lightning seller. Samples sent on trial. Kristee 53, Akron, Ohio.

SELL New Automatic Floor Waxer. Trigger on handle. Retails $2.95. Your profit 125%. Write Smith, Inc., Greenfield 22, Mass.

AGENTS—Show America's leading Nationally Advertised line—Novelties, Gifts, Utility Items. 100% Profits. Prospects Everywhere. Steady Repeats. Write today for sensational low prices, free literature. Charms & Calm, 407-PS-24 South Dearborn, Chicago 5, Illinois.

BIG Money selling waitresses, beauticians, others, guaranteed uniforms $3.98 up. Nylons, cottons. Sizes 9-52. Free bonus uniform. Full, part time. Experience unnecessary. Free full color catalog. Upland Uniforms. 208 East 23rd, Dept. H-7, New York.

OWN A Business! Private Labels! Exclusive Sales! We supply product, plan, literature; you furnish management, employ salesmen, get terrific over-ride profits just for being Boss. Details Free. Vitaline, 2968-PSA Beverly Boulevard, Los Angeles 57.

GOLD or Silver letters, numbers. Windows, Doors Trucks. 1" to 6". 500% Profits—Free Samples. Atlas-U, 544 West 79th, Chicago 20.

BIG Money making opportunity. Exclusive line work uniforms. Jackets, pants, shirts, coveralls. Advertising embroidered. Every business prospect. Sell Free. Master Div., 157 Water Ligonier, Indiana.

EARN $50 weekly. Spare time selling vitamins! Dept. SPF, Emm-Bee, Box 992, New York 8, N.Y.

101 DIFFERENT Ways to Make Extra Money! Sell "lifelike action" Greeting cards. Make $50—$75—$100—more. Win famous products as bonus. Write for free cure All Occasion assortments on approval, free samples. Name Imprinted Stationery, free color Catalog. Selling Guide. New England Art Publishers, North Abington 233A, Mass.

CALENDARS, Advertising Novelties, Matches. All styles. Including Religious. Varnished. 12 sheet. Girls. Hundreds of Advertising Novelties. Book Matches, etc. Fleming Calendar Co., Promotional Division, 6539 Cottage Grove, Chicago 37, Ill.

CLEANS Windows without mess. Strange "Dry" cleaning-cloth. Replaces liquids. Windows gleam. Samples sent on trial. Kristee 52, Akron, Ohio.

MAKE Extra Money Fast. Sell Telephone Shoulder Cradle. Mission, 4180-PS, Oakland 9, California.

MAKE Money Introducing World's cutest children's dresses. Big selection adorable styles. Low prices. Complete display free. Rush name. Harford, Dept. L-3341, Cincinnati 25, Ohio.

BUY Wholesale thousands nationally advertised products at big discounts. Free "Wholesale Plan." American Buyers, 629-S Linden, Buffalo, New York.

MAN to earn $150 and up per week. Long needed invention. Advertised worldwide. Prospects are everywhere. Full or part time. Exclusive. No investment. Free samples. Write Red Comet, Inc., Dept. 391-H Littleton, Colorado.

BEAUTIFUL Feather Pictures. 200% Profit! Free sample. Apartado 9036, Mexico 1, D. F.

MANUFACTURER of 16 guaranteed household and electric products. $1 to $15 offers big profit deal. Sibert Company, Newark (3), New Jersey.

AT Last! Something New and Sensational in Everyday Cards. 21 for $1. Make Extra Money Fast! Show Satin, Velour, Metallic Cards. Get orders easy. Big line $1 assortments. Scented Stationery, Personalized Napkins. Gift Items. Imprints Free. Several $1 boxes On Approval. Puro Co., 2801 Locust, Dept. 441-B, St. Louis 3, Missouri.

Is $210 a week worth a postcard to you? Then rush card with name and address for special Free Trial Plan that sells amazing new Automatic Refrigerator Defroster "like hot cakes!" Write to Mr. Lewis, D-Frost-O-Matic Corp., Dept. L-103, 173 W. Madison, Chicago 2, Ill.

VOLUME Sales. Power mowers. Chain saws. Prepaid. Terms. Farmco-PS. Excelsior Springs, Missouri.

MAKE Extra Money. Sell front door name plates to friends, neighbors. Retail $1.98—you make $1.00! Free selling kit. Modern Engraving Co., P.O. Box 194, Boston 14, Mass.

CALIFORNIA sweet smelling beads, sensational sellers. Particulars free. Mission, 2322 West Pico, Los Angeles 64, Calif.

EASY handwork makes fast-selling useful articles. Sample free. Sunmade Company, Brockton 64, Mass.

AGENTS—Distributors, Canvassers—Promoters—"The Wonder Tool" now being advertised very extensively on television and newspapers. Replaces knives, scissors, lawnmowers, etc. Cuts glass. Your price, send $1.00 for two samples. We pay postage. Dozen $5.00, Gross $48.00. ½ Cash, Balance C.O.D. Telegraphed orders will be air expressed or airmailed. Albert Cahill Steel & Tool Works, Adams Avenue, Toms River, New Jersey.

SCHOOL Seniors—Have Fun and Spending Money!!! Be Popular With Your Classmates. Sell Graduation Cards. Free Sample cards, Box 235-M, Pittsburgh 19, Penna.

MEN! Money! Miracle Spray-A-Tint tints windshields—gives merciful glare-protection—plus new 1954 look! Sprays on in jiffy. Reduces glare from sun, snow, headlights, etc. Lasts all year. Auto, truck owners buy on sight! Profits 100% up! Spray-A-Tint, Dept. PS-2, Consumers Bldg., Chicago 1, Illinois.

SALESMEN—$50.00 in a day definitely assured, selling brand new item going to every type of food and beverage store, factories, laboratories, hospitals, samples Furnished. Utility Durawear, 53 West Jackson Blvd., Dept. PS-2, Chicago 4, Ill.

FREE book "500 Small Successful Businesses." Work home! Expect something Odd! Pacific-38C, Oceanside, Calif.

GET New Shirt Outfit Free; make $80.00 weekly on 3 average orders a day. Famous quality Made-To-Measure dress and sport shirts at $3.95 up sell fast to all men. No experience needed. Full or part time. Write: Packard Shirt Co., Dept. 602 Terre Haute, Indiana.

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MAKE Your Own Furniture! New 256-page book "How to Build and Repair Your Own Furniture" shows you how to save big money making and repairing tables, chairs, bookcases, desks, cabinets, shelves, much more! Step-by-step directions, hundreds of illustrations. Only $2.49—money-back guarantee. Popular Science, Dept. 254C, 353 Fourth Avenue, New York 10, N.Y.

66 BUILD IT YOURSELF

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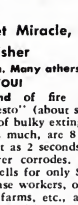

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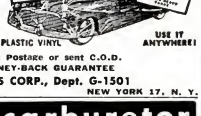

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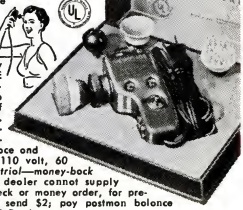

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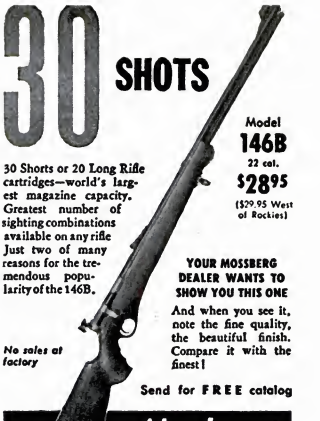

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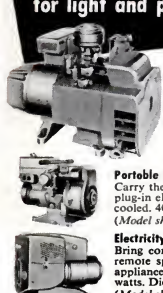

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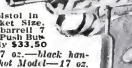

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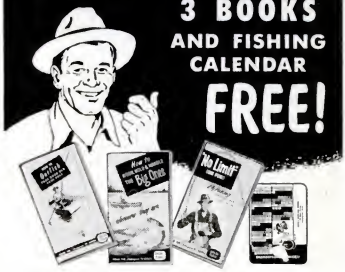

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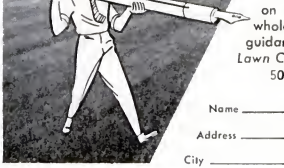

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They buy Champions because the airlines' own laboratory and flight tests prove Champions superior to all other aviation spark plugs. The same engineering, research and manufacturing skills that produce the world's best aircraft spark plugs produce the Champion Spark Plugs for your car.

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MOVING-WALKWAY builders foresee system to take you from your car to your seat in stadium.

Conveyor Belts to Move Crowds

Motorized sidewalks will be a boon to pedestrians and they will speed up the flow of rush-hour traffic.

AT THE ripe age of 63 years, rubber conveyor belts will soon be carrying people. Everything from coal to cabbage heads has ridden millions of miles on belts since the world's first heavy-duty belt was introduced to industry in 1891.

This spring, thousands of New York businessmen who live in New Jersey will step aboard a belt twice a day to save their time and energy. It will operate like the 10-mile-long system that carried 12 million tons of aggregate to help build California's Shasta Dam in 1940 and the five-inch-wide, 25-foot-long ribbon that transports face powder in a cosmetics factory. But it will be called a Speedwalk, and its passengers will be free to stand or walk while riding its 227 feet.

The Hudson and Manhattan Railroad, which runs trains to and fro beneath the Hudson River separating New York from New Jersey, is installing a Speedwalk. It will connect the platforms where passengers board H & M trains with the Erie Railroad terminal in Jersey City.

This belt will be in a tunnel through which 14,000 persons per hour race twice a day. The Speedwalk is expected almost

FOR BULK MATERIALS, such as coal and ore: Spilling is prevented by using idler rollers set at an angle to shape the conveyor belt into a trough while also supporting it.

to double the tunnel's present capacity.

The belt, made by Goodyear, will be a 6½-foot-wide strip of thick, three-ply canvas impregnated with a compound of synthetic and natural rubber. It will be driven by a 20-horsepower motor at a speed of 1½ miles per hour. For 127 of the 227 feet that it will extend, it will carry passengers up a 10-percent grade.

Handrails will move at the same speed as the belt. Passengers will step on and off as if it were an escalator, and the belt will move in whichever direction the traffic is heavier. Paralleling it will be a walkway for those going in the opposite direction and timid souls who shy away from labor-saving machinery.

Belt Would Replace Shuttle

This aid to modern commuting is being built by the Stephens-Adamson Mfg. Co., and installing it will cost about $75,000. Two more Speedwalks, extending 350 feet farther, may be added later.

Both New York City and Cincinnati are seriously considering plans for solving traffic problems with similar conveyor belts. In New York, a four-block-long system extending from Times Square to Grand Central Station has been proposed. This would take the place of overcrowded subway trains that now clatter back and forth over a so-called "shuttle" line. And in downtown Cincinnati, a two-way subway belt-conveyor loop has been proposed to uncork bottlenecks in a six-block-long and three-block-wide area.

Venturesome visitors to the Columbian

Exposition in Chicago rode on a somewhat similar moving platform in 1893. It was a chain-driven wooden device that "was always getting out of order." But Thomas Edison had set up a crude belt-conveyor system to carry ore in a New Jersey mine three years previously, which was a forerunner of things to come.

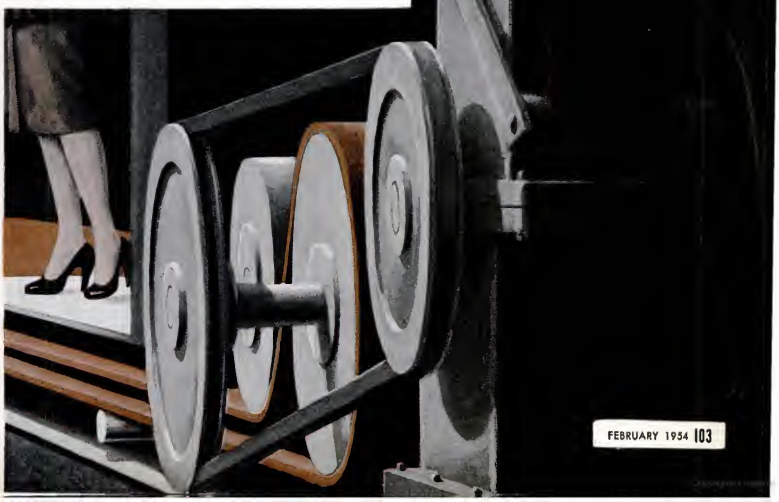
One day in the spring of 1891 a 23-year-old, $12-a-week rubber salesman, Thomas Robins, visited the Edison mine. He saw the light canvas conveyor belts with a paper-thin coating of rubber. The rough and bulky iron ore wore them out in a few weeks.

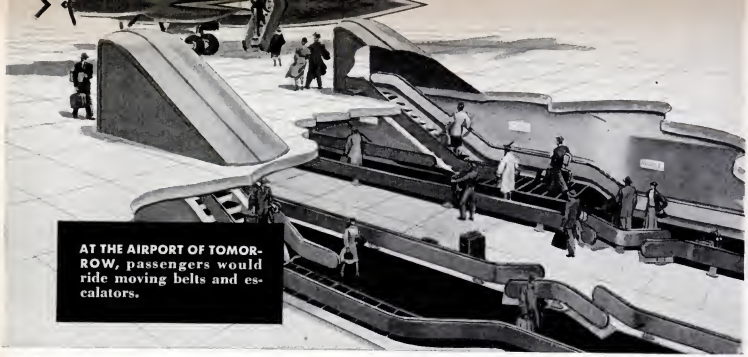
Robins Makes Some Tests

A tough, more abrasive-resistant belting was needed, Edison said. Robins decided that a thicker coating of rubber might do the job. That was a revolutionary suggestion at that time before the rubber automobile tire had been invented; rubber was valued for its waterproofing qualities rather than for its toughness.

Tom Robins experimented with various compounds of rubber. He had ⅛-inch-thick disks of these made up and

FOR PEOPLE: World's first moving sidewalk, shown in sketch below, soon will be in operation in an underground passageway connecting two commuter stations in Jersey City, N. J. Moving at a speed of 1½ miles an hour, the Speedwalk belt conveyor is expected to double the tunnel's present daily rush-hour capacity of 14,000 passengers.





AT THE AIRPORT OF TOMORROW, passengers would ride moving belts and escalators.

IN THE RAILROAD STATION, Speedwalks would have short access and exit belts as shown here.

IN THE BIG SHOPPING CENTER, moving platforms would complement escalators between floors.

rigged them at the end of one of Edison's belts, which he speeded up so that they were struck by a continuous torrent of ore. He added a steel disk for comparison.

After subjecting his samples to this grueling test day after day, week after week, he came up with a rubber compound that was hardly worn by the time the steel disk had almost disintegrated. That compound became the covering for the world's first industrial conveyor belting and was the beginning of a system of continuous mass-materials handling without which today's big industry would be about helpless.

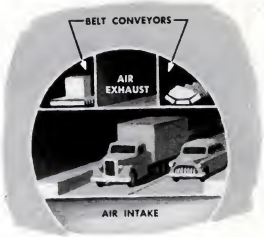
Mountain Is Belted into Puget Sound

Belt conveyors actually have moved a mountain—or what seemed a mountain to the residents of Seattle. It was Denny Hill, right in the heart of the business district. All traffic had to go around it. For decades it was nibbled at, with dirt carried away in trucks. Finally, the city fathers realized that they weren't getting anywhere and installed a system of belt conveyors that spanned the streets. In about a year, three 3,000-foot conveyors moved 6,000,000 yards of rock and earth to barges that dumped it in Puget Sound.

That was in 1928-29. Shortly after that came the era of big-dam building in this country. Without belt conveyors, Grand Coulee, Norris, Shasta, Friant, Anderson Ranch, Hungry Horse and Bull Shoals Dams might never have been built.

What is claimed to be the longest overland system is being installed near Rockland, Tex., to carry lignite, a low-grade iron ore, four miles from the mine to a power plant of Alcoa. Operated by 950 horsepower, generated by eight motors, it will carry 1,000 tons of ore an hour at a speed of 550 feet a minute.

Perhaps the greatest advance since Tom Robins developed his conveyor belt has been the steel-carcass belt which has steel wire or cable embedded in the rubber-impregnated belting. This development, because of its strength, has made possible the construction of longer single flights—such as the world's longest single belt of more than two miles installed in 1949 by Goodyear at the Weirton mine in West Virginia.



Belt Conveyor Proposed for Tunnel

A pair of belt conveyors could be run on each side of the air-exhaust duct along the upper part of the new third tube of the 7,944-foot-long Lincoln vehicular tunnel under the Hudson River. Huge trailer trucks could unload bulk and packaged materials onto these moving endless belts at the New Jersey entrance, thus keeping many trucks out of the tunnel and off New York City's already traffic-strangled streets.

One of the most ambitious projects for belt conveyors is a two-way elevated system running 103 miles between Lake Erie and an Ohio River terminal. This Riverlake Belt Conveyor is now under consideration by the Ohio state legislature. With 172 belts, or flights, some of them more than a mile long, it could carry 52,000,000 tons a year, transporting iron ore south from the lake and coal north from the river.

Will Belts Supplant Highways?

What the belt-conveyor industry has done for materials, it stands ready and eager to do for people. To what extent we will become riders of moving walkways only time will tell. But one writer of science fiction has predicted moving highways for us. Perhaps huge conveyor belts will bring the day when you will use the auto-propulsion of your car only to maneuver on and off a network of fast-moving superthruways.—*Herbert O. Johansen.*

New Paint Job Means: Beware!

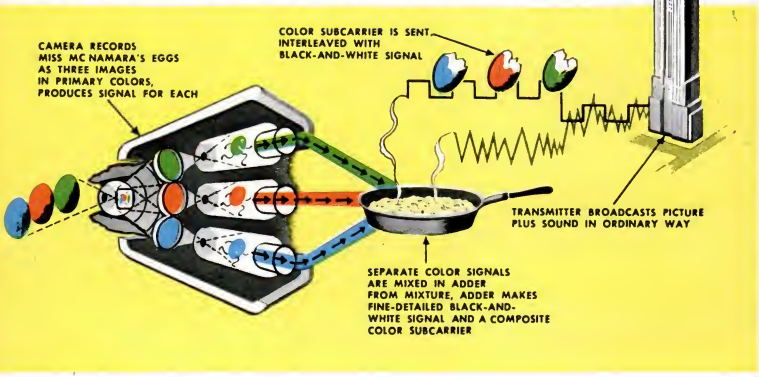
THE peppermint-stick nose and boom of this F-86D Sabrejet test plane warns away other traffic at Edwards Air Force Base, Calif. The telescope-like head on the boom registers air speeds; the vanes measure aerodynamic behavior of the 650-mile-an-hour-plus, all-weather interceptor.

Giant Spider Web of Wire Heads Off Rock Slides

To keep rocks from bouncing onto this four-lane highway near Kelso, Wash., engineers threw a 2,700-foot wire-mesh veil over the face of the slope. A truck-mounted American Hoist Co. unit raised the net 170 feet to the top of the cut while a strongback on wheels (right) kept the 12-foot-wide mesh strips from catching on projections.

Night-Glowing Beacons for Motorists Mark Edge of Driveway

If you have trouble sighting the edge of your driveway at night, these reflector-topped aluminum stakes may be the answer. The Scotchlite marker is said to be visible from any angle when your headlights are on. The D & G Products Co., 2796 Woodhill Road, Cleveland, also makes screw-in Drive-Glos for use on buildings, fences and posts.



IT LOOKS like the hard way, but scrambling colors and then unscrambling them makes possible the new color TV that at last satisfies everybody.

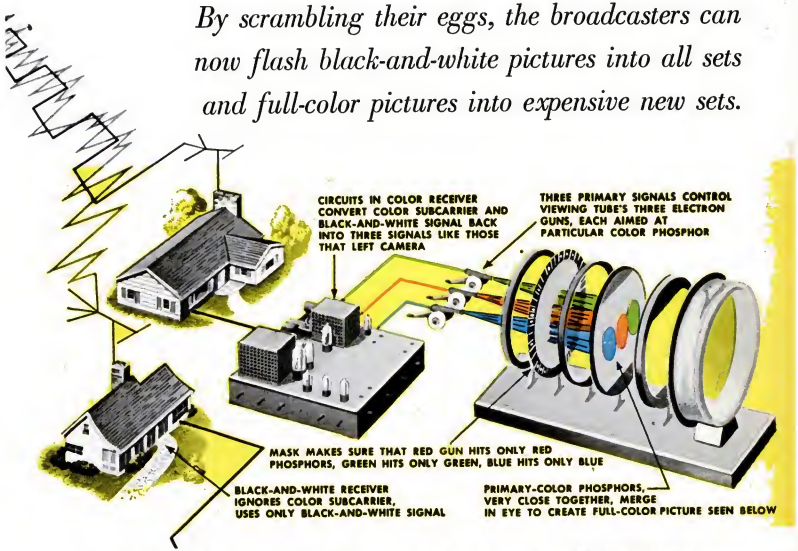
The big color-TV cameras take three pictures, one for each primary color. These are mixed to give a black-and-white picture signal and a separate "subcarrier" of color signals. Color receivers use the subcarrier to convert the black-and-white signal back into the three primary-color pictures, which overlap on the color screen and are fused by the eye into full, natural color. Regular receivers ignore the color subcarrier and display the picture in ordinary monochrome.

Recent discoveries in science led to this compatible color inside a regular TV channel. Eye researchers found that a natural picture needed only a little color if fine detail appeared in black-and-white. Communications theorists found room for bursts of color information in the crowded TV channel.

Color receivers should be available by Easter. Cost: $800 up. Worth it? Well, look at the unretouched full-color photos on these pages—one shot in the studio, the other off the screen of a color receiver.—*Martin Mann.*

How They Crowd Colors into TV Channels

By scrambling their eggs, the broadcasters can now flash black-and-white pictures into all sets and full-color pictures into expensive new sets.



COLOR QUALITY IS REVEALED in PSM's simultaneous color photos of Marie McNamara, NBC's Miss Color TV. Facing page shows studio scene; shot at right records image on a color-TV screen. Below is what you would see on a black-and-white receiver.

READY FOR HEAVY TRAFFIC, the new Venezuelan highway (top photo) quickly links the country's busiest seaport and airport with its capital. Telephone cables run under the center strip.

The biggest bridge on the *Autopista* (left) is near the Caráeas end of the route. Ninety-six percent prestressed concrete, four percent steel, it was built by a French firm.

Slicing through the Andes at $6,000,000 a mile, new road is

World's Costliest Highway

NO LONGER does the main highway from the Caribbean shore to Carácas, Venezuela's mountain-circled capital, wiggle for 19 miles around 365 curves, labor up 12-percent grades and take frightened travelers more than an hour to drive.

In December, the *Autopista,* a shining new superhighway, took its place. Begun three years ago, the *Autopista* (meaning "auto track," or speedway) cost $6,000,000 a mile, which makes it the world's most expensive road. But it has shortened the route to Carácas to 10½ miles—a 15-minute run. It has only 36 curves, all of them wide and gentle, and its steepest climb is an easy six-percent slope. It is a toll road, and the government expects it to pay for itself in about 20 years.

The *Autopista,* lighted at night from one end to the other, is a four-lane, divided highway of concrete, topped with a two-inch cushion of asphalt. It runs through magnificent mountain country. Along the road's 164-yard right of way, moreover, the

GONE ARE THE WIGGLES that used to mark the road from the sea to Venezuela's capital. The broad new route has lopped off 329 curves, is eight and a half miles shorter than the old.

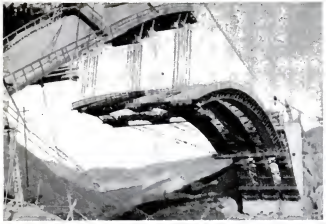
TORTUOUS PAST is recalled by this view of the crooked road that the *Autopista* has supplanted. It was a slow, dizzying route, over which 6,000 cars and trucks crawled each day.

SLICING AWAY MOUNTAINS to fill awesome gaps in the terrain was a huge, costly and gymnastic job for the road builders. Depth of the gaps ranged from 78 to 141 feet.

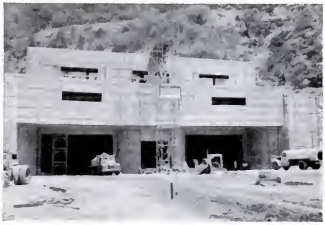
Venezuelans plan to add a few embellishments to its natural beauty. They are setting out plants and shrubs, both for adornment and to prevent soil erosion.

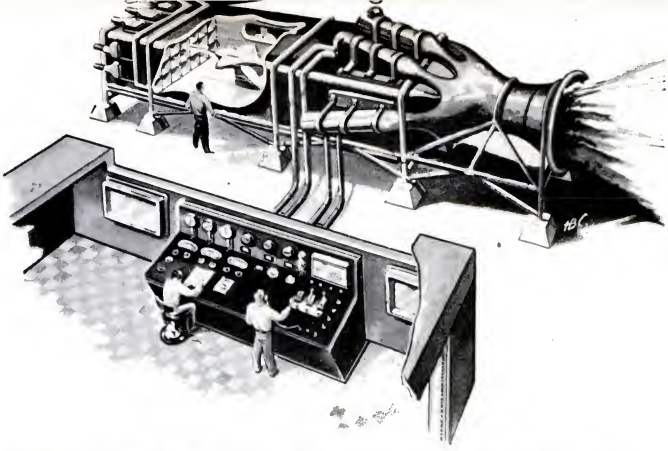
Piercing 6,000-foot peaks, the *Autopista* passes through two giant, well-ventilated tunnels, one of which is more than a mile long, and crosses the three largest prestressed concrete bridges ever built.

HOISTING THE MIDDLE SPAN of one of the *Autopista's* three prestressed concrete bridges.



MORE THAN A MILE LONG, this tunnel leaves 39 feet of rock between dual lanes of traffic.





Rockets to Suck Air Through 1,000-M.P.H. Wind Tunnel

ROCKET motors may be put to work powering a wind tunnel capable of producing gales up to 1,000 m.p.h. at pressures equivalent to altitudes up to 60,000 feet. As envisaged by University of California engineers, the exhaust from six rocket-engine thrust chambers would power jet pumps arranged to suck air through the tunnel. A conical plug would act as a throttle, changing the volume of air as desired. The designers figure the rocket tunnel could be built for $250,000.

Mulberry Now *Stops* an Invasion

FOUR huge concrete caissons—each as high as a seven-story building—have closed the breach in Holland's dikes, smashed by last year's floods. The last one is shown being nosed into position. All were built in Britain for use in the Normandy invasion as part of an artificial port dubbed Mulberry.

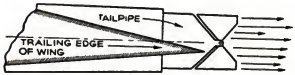
Mixer Makes Water Wetter

A FIRE-FIGHTING chemical to make water wetter by breaking up thick-skinned drops now comes in cartridge form. Inserted in a blender, it is fed to the hose stream automatically. The maker, Aquadyne Corp. of New York, says the treated water will penetrate the most stubborn blaze.

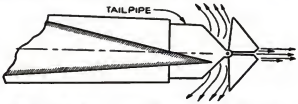
Scooter Speeds Ramp to Planes

MIDGET gas buggies do a lot of odd jobs in Italy. Here a scooter has been harnessed to a Rome airport passenger ramp. It saves not only time, but manpower too, as just one assistant is needed to guide the driver to the plane's loading door.

Reverse Thrust to Brake Jet Airliner For Short Stops



NORMAL THRUST: rear of tailpipe is split into two hinged sections. When closed in flight, all exhaust gases go rearward.



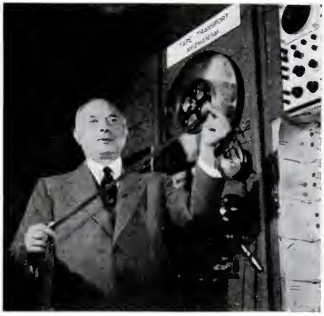
REVERSE THRUST: opening sections, as above, cuts down rearward exhaust, reversing 40 percent of thrust for braking on ground.

A DEVICE in the tailpipe of a proposed jet airliner would provide reverse thrust and is expected to shorten its landing run from 2,500 feet to about 1,400.

The Fairchild M-186 is being offered, in

Tape to Record Both Color and Black-and-White TV Programs

BOTH the sight and the sound of color-television programs can be recorded on ordinary half-inch magnetic tape by electronic equipment, now under development by RCA. The system provides for immediate playback. RCA's Brig. Gen. David Sarnoff, shown holding the tape, sees the development as a major step into an era of "electronic photography" where television cameras will replace present-day movie cameras, and tape will replace film for both commercial and home movies.



The equipment can make video recordings either from the output of a television camera or a television receiver. For color, the tape, moving at 30 feet a second, is drawn across five electromagnet recording heads that record five channels of information: red, green and blue color signals, a synchronization signal and the sound signal. For black-and-white, only two channels, one for video and synchronization and another for sound, are impressed on quarter-inch tape.

For playback, the rewound tape is drawn across similar reproducing heads. The tape can be wiped clean and re-used.

RCA engineers expect to have the equipment ready for commercial use in about two years.

the drawing-board stage, to U.S. airlines as a fast, twin-engine jet liner and cargo plane for one-stop transcontinental flights. Two Wright J-67 engines, each with a thrust of 12,000 pounds, would enable it to cruise at 570 miles an hour at altitudes above 40,000 feet.

The plane has a high "cusp" wing (a combination of delta and straight wings), a towering horizontal tail and rear-of-fuselage loading. A side-bubble canopy would give pilots added visibility. A 44- and a 64-passenger version have been designed. Provisions are made for a quick conversion to military use for carrying troops or cargo, and for dropping paratroops.

Army's First Rudderless River Towboat Makes Fancy Turns

TWELVE spinning, four-and-a-half-foot metal blades, projecting downward into the water, are both propellers and rudder of an experimental Army towboat. It is seen at lower right turning in its own length during a recent demonstration on the Ohio River near Pittsburgh. Steering is done by changing the pitch of the blades, shown below.

Each propeller unit of six blades is turned by an 11-foot rotor sunk in a well in the stern of the boat. The rotors are driven through shafts from two 12-cylinder, 1,000-horsepower diesels. Aside from the advantages of extreme maneuverability and increased power over comparable screw-type units, the vertical-axis propeller-rudder blades can be changed without putting the craft in drydock.

King-Size Motorcycle Clocks in at a Royal 130 M.P.H.

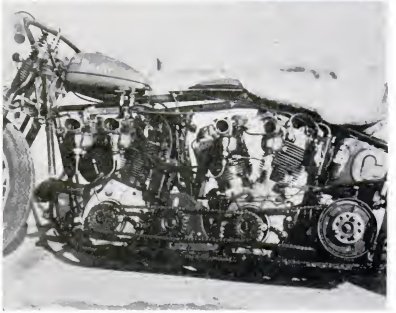
Two tandem engines drive this massive job along at a roaring 130 m.p.h. Nicknamed the "Monster" by its builder, 26-year-old Bob Schmitt of Chalmers, Ind., the four-cylinder motorcycle was made from parts of two Harley-Davidsons, a John Deere tractor, and some beer cans (for carburetor intake shields).

Bellied down on an elongated saddle to cut wind resistance, Schmitt guides his super-cycle with handle-bar controls, keeps himself aboard by jamming his feet against the rear transverse braces (upper right).

Original engine power was jacked up by installing Chet Herbert cams and reaming out piston displacement from 61 to 80 cubic inches. New compression ratio is 12:1. Methanol sucked in through dual carburetors supplies the fuel. The plump rear wheel is driven through a complex chain rig (lower right).

Because of its gearing, the Monster takes an eighth of a mile to get up to 80 m.p.h., another eighth to reach top speed: 129.87, clocked at Chicago's Maremont Speedway.

Schmitt drives 300 miles to Chicago each weekend during the racing season. Next year he's heading for the salt flats at Bonneville, Utah, where he figures he can *really* let her rip.



Tiny Electronic Device Emits Timing Signal for Auto Races

PACKED into a tiny 4"-by-2" case and weighing in at one pound, a new Evans Engineering radio transmitter promises to eliminate human error from the timing of auto races. The raceway network calls for a transmitter, set on a different frequency for each car on which it is mounted (right); and a receiver, which clocks the signals as cars pass. At left, Indianapolis Speedway's Wilbur Shaw examines the receiver.

New Channel Master Champion antenna is inspected by its designer, Dr. Lo, and boss Resnick.

TV Antennas Made Him Rich

Television version of the better-mousetrap formula has built 29-year-old Joe Resnick a $12,000,000 business in six years.

By Herbert O. Johansen

TEN years ago Joe Resnick's closest contact with the infant television industry had been an appearance as a guest on an audience-participation program. But experience as a radio operator was enough to get him a job as a junior engineer in a New York TV company at $32 a week. Last year his own company, the world's largest manufacturer of TV antennas, did a $12,000,000 business.

Today, at 29, Joe Resnick, although chairman of the Board of his Channel Master company, is more or less retired—enjoying his hobbies of photography,

A farm boy brings bustling industry to his home town

fishing, horseback riding and ceramics—and waiting to latch onto something new.

He has come a long way in a short time for a boy born on a truck farm, in the lower Catskills at Ellenville, New York, that raised rocks more readily than crops. Joe didn't finish high school. His technical education was meager. When he started his business, capital consisted of $7,000 his older brother, Lou, had made in the sauerkraut business, and $2,500 borrowed from a local grocer.

What was Joe's contribution? He answers the question himself: "I was in the right place, at the right time, with the right idea."

That idea was a preassembled TV antenna that could be installed quickly. As time went on, his antennas also became better engineered, mechanically and electronically, for better TV reception, especially in fringe areas. The recently announced Channel Master VHF tripole Champion is quite a step from Resnick's first antenna, which was copied from the pages of *The Radio Amateur's Handbook.*

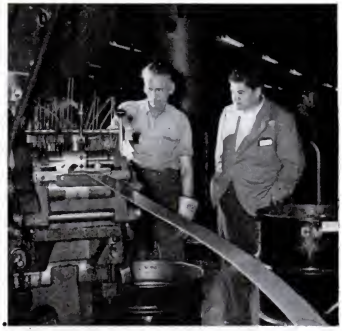
Antenna Can Be Assembled in 90 Seconds

Back of the Champion are some 90,000 measurements, two years of experimental work, $100,000 in research money. A new kind of antenna claimed to furnish the power of three separate antennas, the Champion can nevertheless be assembled, ready for the mast, in 90 seconds. It was designed by Dr. Yuen T. Lo, hired by Resnick because he is one of the few men who have written a doctoral thesis on the subject of television antennas.

The first 23 years of Joe Resnick's 29 years can hardly be held up as a blueprint for success. His career at Ellenville High School proved something of a disappointment to both Joe and his teachers. They parted company in the middle of his senior year, in 1942. Joe, in true "rags-to-riches" tradition, left the farm for the big city. In New York he enrolled in a course in radio fundamentals. When the military services rejected him on physical grounds, Joe joined the Merchant Marine as a radio operator and served on tramp freighters, mostly on the Atlantic run, until he received a medical discharge late in 1944.

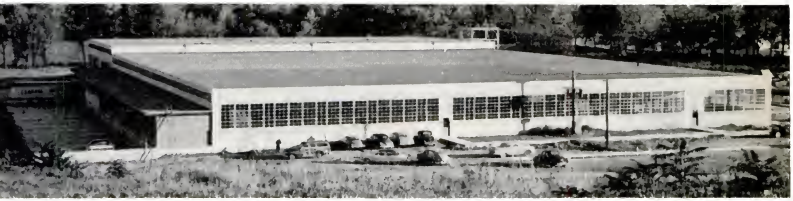
With manpower short at that time, Joe's radio-operator experience was ample to get him a job as a junior engineer at the Du Mont television company.

FIRST preassembled TV antennas were made in this small Ellenville, N. Y., building the Resnick brothers rented for $40 a month.



ASSEMBLY-LINE production methods enable the Resnicks to turn out more than 2,500,000 preassembled antenna units a year. In 1953 400,000 pounds of aluminum were used.

Lab-developed designs keep automatic machines busy



JUST COMPLETED is this new Channel Master plant, with 115,000 square feet of space. Equipment includes huge aluminum-extrusion press, specially designed drawbench and devices for testing all kinds of materials that go into making television antennas.

After a time. Joe shifted to the service division, where part of his job was installing antennas. These could be put together on the ground and the assembly carried aloft, with a good chance of bending or breaking the elements. Or, you could assemble them on the roof while clinging precariously to any handy support.

New Kind of Antenna Needed

Surely there was need for some other kind of antenna. Joe filled the need by forming the Oak Ridge Antenna Co. Money came from some partners and $500 was taken from the sauerkraut till by an older brother, Harry (now president of Channel Master).

But business was only fair, and a disagreement developed among the partners. Most of them felt that the time was not far off when TV receivers, like radios, would not need big outdoor antennas. They wanted to put the firm's money into installation and servicing. Joe, however, believed that TV antennas were here to stay, so he pulled out.

He owed about $10,000, but a vague idea that had been bobbing around in the back of his head for some time was fast taking shape. He knew how to make a simple, practical, preassembled antenna —how to pivot the elements on fixed nuts, how to slide one tube into another and lock them.

Back in Ellenville, Joe, now 23, ex-

AN ENGINEER adjusts electronic equipment used in testing antenna performance. Joe Resnick, in background, hires top men to engineer antennas mechanically and electrically.

LABORATORY has its own VHF and UHF transmitters. Tower, resembling oil-drilling rig, has pivoted arm on which antennas are mounted and then raised for testing.

Television-antenna tycoon enjoys life at home with his family

WITH TIME to ride his hobbies, Joe Resnick doesn't stray far from his new Sands Point, N. Y., home. Cabinet of hi-fi record player and radio is of his own design. His still and movie photography stars his wife Ruth, daughter Deborah, son Jeffrey. Lower photo shows Joe at kiln for baking ceramic tile.

plained his big idea to his brother Lou. Lou liked it. They formed a company called Channel Master Corp., hired a mechanical engineer for $50 a week and began manufacturing the world's first preassembled TV antennas.

In those early days, Joe would don a business suit in the morning to go out selling antennas. When he got orders, he would rush back to the plant, change into work clothes and help build and package the antennas.

During the first year, Channel Master used 30,000 pounds of aluminum, turned out about 5,000 antennas, did a $75,000 business.

Last year, the sixth year of Joe Resnick's brain child, it used 400,000 pounds of aluminum, shipped some 2,500,000 preassembled antennas selling for $12,000,000.

Today about 1,000 employees are working in two plants, one a brand-new, sprawling structure with 115,000 square feet of space.

Staff Works Three Shifts

There is a laboratory staffed by 26 electronic engineers and technicians working on three shifts. It is located in the lowest part of the valley, almost a TV dead spot. With their own VHF and UHF transmitters for testing new antennas, this is an advantage because they can operate under controlled conditions with no outside interference.

The research-and-development laboratory is Joe Resnick's pride and joy. Although he is admittedly a promoter and salesman who can hire top technical talent, and does, he is a great booster of specialized training as a foundation for success.

He believes, for instance, that a young man planning to go into selling should first get a thorough technical background in the business he expects to enter.

"If security is a prime consideration," he advises, "then by all means go with a big company. But if you are willing to gamble a few years, find yourself a place with some small, growing venture." END

Tail Light from the afterburner of a Navy Skyray illuminates the airport with a long tongue of yellow flame as the new triangle-wing fighter shows its power in ground tests. The boosting effect of the afterburner is expected to push jet fighters to 1½ times the speed of sound. The Skyray holds the present world's official speed record—753.4 miles per hour.

Chemical "Flower" blooms when three types of crystals of zinc sulfide are arranged on a black backdrop. The surrealistic gladiola above, as well as other imaginative blossoms, were created by Dr. W. W. Piper while studying crystals that light up in an electric field.

Blue Chips spew from tough steel as new lubricants are used for machine cutting. The splashings on the turret lathe below are water plus additives, chiefly sulfur and chlorine. These coat metal so tool won't weld to work. Standard Oil of California developed the new lubricants.

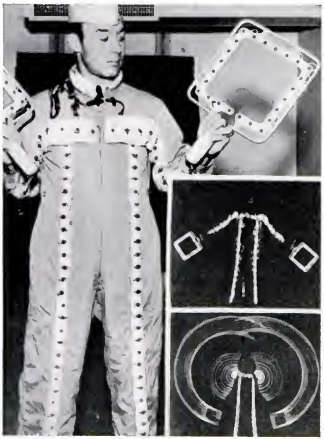
Photographer Gets Tough Shot

How would you like to sit tight in the path of this flying boat while it thundered down on you over a watery runway? That's how John Gaydos got the striking shot above. Crouched in a speedboat, he and

Flying Tiger (and Elephant, Too) Star in Siam Air Show

When the Siamese want to make like Flying Tigers, they turn to helicopters. The photos above show how two copters were turned into aerial floats to amuse spectators at a Royal Thai Air Force show. The spinning rotors of a Hiller put the tiger in the air and a Westland Sikorsky gave the elephant wings. A third copter was parked on the roof of the airport's administration building with a doctor and a nurse standing by, but the whole show went off without a mishap. Even the animals never tangled.

the skipper waited like sitting ducks while the plane shot toward them over Chesapeake Bay. Gaydos clicked the shutter and the skipper veered the boat out of the way seconds before the Martin XP5M-1 took off.



Signalman Wears Homing Lights

THIS landing officer is all lit up like a Christmas tree to signal returning planes safely aboard a carrier. Insets show how he looks at night when the tiny bulbs in suit and paddles are illuminated.

Copter Serves as Lineman

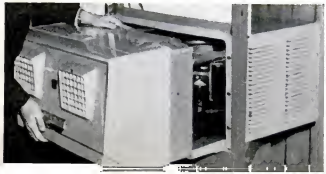
THIS Army copter sets up phone lines in mountains and jungles by toting poles vertically and dropping them into prepared holes (top photo). Then the H-25 flies sideways and drapes cable over the crossarms (center) by unreeling it from an open door. As fast as the aluminum poles are set, ground crews anchor them and linemen secure the cable to the crossarms.

Dear Bill: Here's what you want to know about the New Air Conditioners

ROOM SPACE IS NO PROBLEM with an air conditioner like this. It takes in and discharges air at the back, so it can be mounted flush with the inside wall, with drapes closing over it, or in any one of 18 positions.

YOU CAN DIAL YOUR OWN WEATHER on some of the new coolers, which have fancy control boards. You can cool, heat or dehumidify the room, exhaust stale air or blow in fresh.

EASY TO INSTALL AND SERVICE, the motor of this 1954 air conditioner slides in and out. The smallest units run on regular, 110-volt house current. The big ones take 220 volts and require a special circuit.



About 1,500,000 American families are expected to invest in them this year.

So you and Sarah will be in style.

I can give you a preview of the 1954 models because I've just gotten back from the big air-conditioning show in Cleveland. The manufacturers were showing all the things they're going to be pushing next summer.

Some of them were mighty interesting.

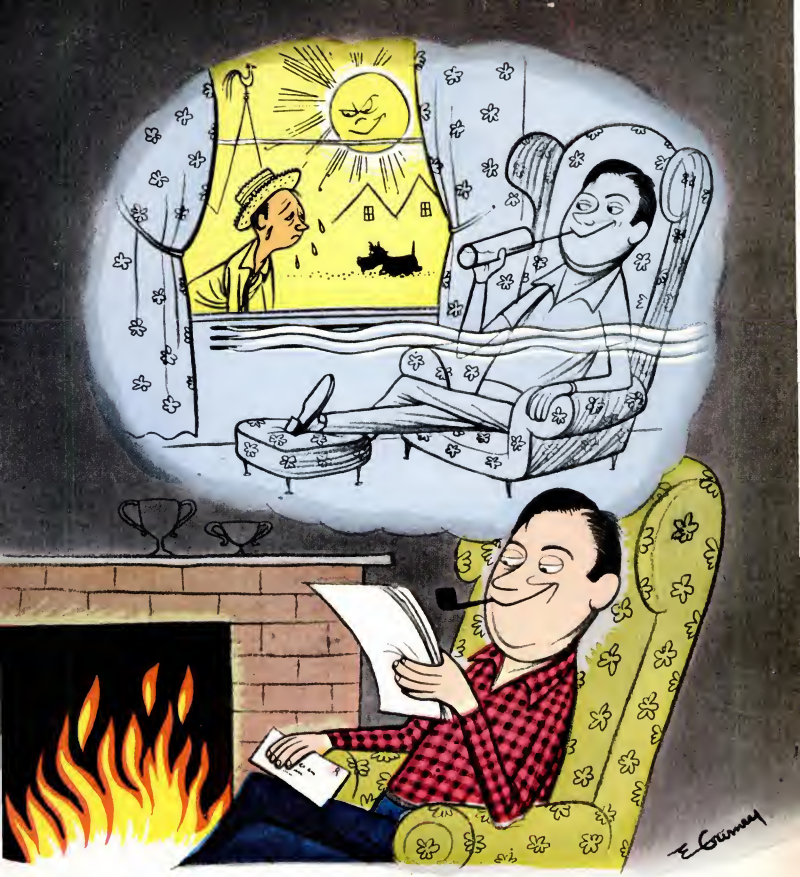
You know that previous room air conditioners have often been pretty noisy. Well, this year's window boxes have smaller, quieter motors. They have plastic or other sound-deadening cases. They have baffles between the motor and your room to keep things quiet. Some even stick out the window farther than ever, for the same reason.

Some Go into Reverse

Heaters have been added inside a lot of them, Bill. Thus the air conditioner can warm as well as cool, and can take the chill off a room. Nice for late-spring mornings!

Sarah will be glad to know that a lot of the new models have their air scoops underneath instead of at the ends, so they can't suck in curtains and pull dirt through them like the old ones did.

Another word for Sarah: She asked me once how often to clean the air conditioner's filter. I found it should be vacuumed or shaken out once a month at least. But in a factory city, like yours, it ought to be done oftener.



By the way, I saw a fancy gimmick on one window conditioner that puts an end to filter cleaning. It was a filter that works like a towel dispenser. You pull it down when it gets dirty and cut off the soiled section. In doing this, you have pulled a clean section into place.

Some of the new models have as many controls as an airplane, it seems. But my friend George Jones tells me you needn't worry about them. He says they're sort of like the controls on a new TV set—once you've learned how to tune in, you don't fiddle with them.

George is an old hand at air conditioning, so I asked him quite a few questions about it.

For instance, do you need insulation before you buy air conditioning?

No, he said, but it's like heating; it

AN AIR CONDITIONER ON WHEELS, this model can be rolled from room to room. But it must always be hooked up to a water supply as well as to electricity, and thus trails lines.

costs less to operate if you have insulation.

What should you do before you install a room air conditioner?

Decide which room it's going in, George said. Some people prefer to cool the bedroom, some the living room, some an invalid's room, some the TV den, and so on.

Next thing, George said, is to estimate the size of air conditioner you need. (Your dealer should be able to help you there.) Then make sure your wiring will carry the extra load. Even a small room air conditioner is a bigger appliance than any you may own, except in the kitchen and basement. To play safe, have an experienced electrician test the circuit. Then, if you find it is really necessary, you can have a special circuit installed.

A HANDSOME DISGUISE for one new cooler is this console, which stands on the floor. Other '54 models come in a wide range of colors, able to blend with nearly any scheme.

It'll cost you about $7.50, maybe more, to have a window box installed. But why not put it in yourself? George says "it requires no brains, special knowledge or special tools." That ought to include you, old boy.

It involves erecting the braces or frames that hold the window box on the outside of the house, then lifting the air conditioner onto the sill. (You and I could do this easily; a window air conditioner weighs only 100 pounds or so.) It also involves fastening the window in a permanently closed position. Then you plug in your window box and you're all set.

It's lucky you have double-hung windows. They're the easiest to work with. If you had casements, you might have to remove a pane so your air conditioner could reach the outside air. Or you might have to get one of the air conditioners specially made for casements.

A Way Out of Window Troubles

One neat solution to the problem that I ran across was a whole new, airtight window, with a place for an air conditioner in it, which you can buy and substitute for a casement or any other window.

Maintenance, you'll be glad to know, doesn't amount to much.

Window air conditioners used to be taken down in winter; now they can stay put the year around. You wipe off the unit with a damp cloth or wax it, then cover it with a weatherproof slip for the winter. The main thing is to keep the filter clean.

It's a good idea, too, to have the air-conditioning man check your unit

IT LOOKS LIKE A FURNACE, but this heat pump can cool the whole house as well as warm it. Electric-powered, it costs $10 to $40 a month to run and is recommended for mild climates.

TOMORROW'S DUCTWORK for air conditioning will be cheaper and easier to put in than today's because of this new flexible tubing, which is not yet available for homes.

once a year, just as you have your furnace looked at.

I realize that there's a pretty good hot-water heating system in your house. That's why I've assumed that you would add single-room air conditioners. If you were going to rip out your old furnace, radiators and pipes, I would have suggested your getting a year-around air conditioner—a central station replacing the furnace. You'd have to install new ductwork, but then you'd have the kind of air conditioning they're putting into new homes (PSM, March '53, p. 152). Incidentally, you can even buy central air conditioning with prefabricated houses this year. Four of the biggest U. S. prefab manufacturers are providing it, for from $600 to $1,200 a house.

People with an Inside Track

People who already have warm-air heating in their homes have a problem that's different from yours. If they have a blower, chances are they need only to add a cooling unit to the present furnace. If they have no blower, they probably will add blower, cooling unit and bigger ducts (cool air requires larger ducts than warm air). Then they will have central air conditioning that will cool the whole house.

Another thing that cools the whole house from one spot in the basement or garage is what is called a heat pump.

Heat pumps, run by electricity, are refrigeration systems that during the winter extract heat from the outside air, a well, lake or from the ground, and in summer reverse the procedure, passing heat into any of these, thereby cooling the house. Heat pumps are generally most satisfactory in mild climates.

One Taste and You're a Goner

So far, I learned, there are only about 1,000 heat pumps in the U. S. But some experts see in them an answer to future fuel shortages, and new models are on the market. Look into them when you build a new home.

I have to warn you, Bill, that you are probably hooked for good. Salesmen I talked to told me that your first air conditioner is a "taster"—and you will go on from there, they say, to install either more room conditioners, as George Jones did, or a central system.

This is because air conditioning does so much, the salesmen told me. They say that because of closed windows, it cuts traffic noise. Because it filters the dust, it cuts down the frequency of repapering and painting. Because it filters pollen, it helps hay-fever victims.

So you're on the right track, Bill. Best regards to you, and love to Sarah and the kids.

Yours,
GARDNER SOULE

Flying Seed Yields Nature's Secrets of Flight

OVER in Java, where the coffee grows, there is a peculiar vine that produces a flying seed. The seed is cradled in what looks like a "flying wing" airplane. Now it's being studied in this country for fresh clues to gliding flight. The seed is flown in a laboratory, while a full-size, German-made glider shaped like the flying-wing seed is flown over the Mississippi countryside to see what the seed has got that man hasn't yet discovered.

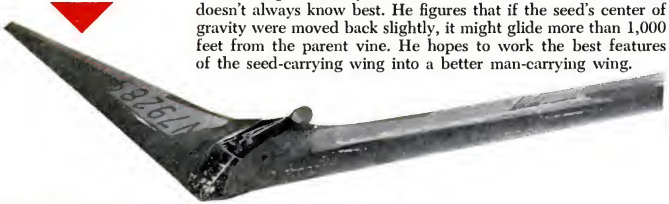
The seed's wings are almost as thin as tissue paper. Dropped from a height of 100 feet, it will sail for 450 feet before hitting the ground. And—what really interests the scientists—the tips of the wings flex up and down so the thing won't capsize.

Dr. August Raspet of the Engineering Experiment Station at State College, Miss., who is conducting the investigation, says birds' wings flex the same way.

The seeds grow in a big, gourdlike fruit on vines that climb to the tops of the tallest jungle trees. The Zanonia vine, as it's known, discharges seeds when the fruit matures.

Dr. Raspet already has determined that Mother Nature doesn't always know best. He figures that if the seed's center of gravity were moved back slightly, it might glide more than 1,000 feet from the parent vine. He hopes to work the best features of the seed-carrying wing into a better man-carrying wing.

COMPARATIVE flight studies of the Horten IV flying-wing glider (below) and the Zanonia gourd seed from Java (above) are being made.

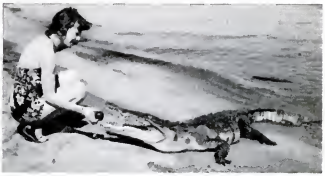


Craftsman Creates a Wooden Giant for the Atomic Age

THIS woodworker—follower of an ancient trade—is fitting a rib into a giant pattern to help along the new artisans of atomic energy. The wooden form will shape a mold for casting part of a steam turbine for a 200,000-kilowatt generator unit that Westinghouse will install in a new atomic-energy plant near Portsmouth, Ohio.

GI Builds Rolling Bunkhouse

T/SGT. L. E. Bouldin added the plywood canopy to the Ford V-8 pickup truck above to shelter him during transfer from Parks Air Force Base, Calif., to Alaska. On arrival, he removed the folding bunk and set up power tools to build a home for his family.

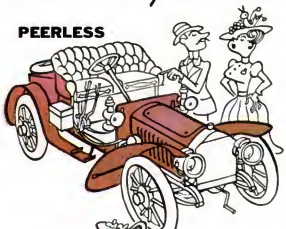


Plastic Reptile Looks Real

THAT crocodile the lady is tempting is plastic. Cast in a mold from a genuine 10-foot one, he looks real enough to bite. The Milwaukee Public Museum developed the new method, after years of experimentation, to reproduce specimens for exhibit.

For 50 Years They've Been Multiplying

"The Seductive Pleasures



BEFORE you begin your leisurely browse through the next 35 pages of POPULAR SCIENCE MONTHLY, look back briefly at the cars that had just made their bow at the New York Automobile Show 50 years ago.

The excited show-goers, as one reporter lyrically put it, were "all willing converts to the seductive pleasures of horseless motion."

Steering wheels, on nearly every car by 1904, still caused a buzz of talk. Most of them tilted or could be moved forward to accommodate the portly driver.

Ball bearings in the transmission and rear axle were brand-new. The three-cylinder engine, "said to have steady running qualities," seemed to be gaining favor. So did air-cooled engines.

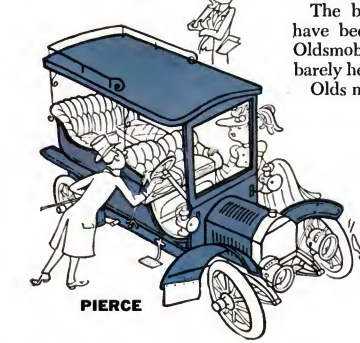
"Who would not dispense with the troublesome water-circulating systems," a columnist asked his readers, "if he were sure that a simple fan could be made to do instead?" Who, indeed?

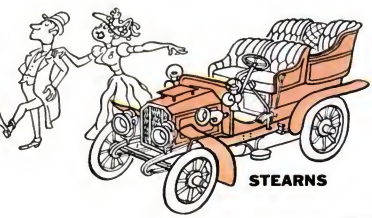
Dry batteries were still almost universally the source of current in cars, but the spark and throttle levers were on the steering wheels of most 1904 models.

The biggest gasps were reserved for the new "canopy tops with glass fronts and side curtains," which now shielded passengers from the elements.

The big-name car makers of today who recently have been celebrating their fiftieth birthdays—Ford, Oldsmobile, Cadillac, Buick, Packard—were seen but barely heard at the 1904 show.

Olds modestly claimed that "The Oldsmobile Goes."





# of Horseless Motion"

Cadillac seemed to feel that it deserved notice for being "The Car That Climbs."

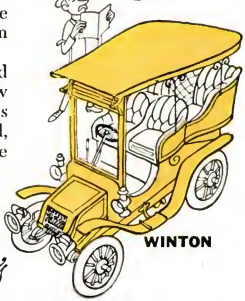
The names that really counted in 1904, however, were Pope-Toledo, Stearns, Pierce, Thomas, White, Peerless, Winton, Knox, Franklin, Stevens-Duryea. Well-known cars were made in such unlikely spots as Syracuse, Buffalo and Chicopee Falls.

The big 1904 event was largely a touring-car show, and the majority of the big vehicles on the floor had four-cylinder vertical engines that were claimed to produce 24 horsepower. A few horizontal engines were displayed, but in one- or two-cylinder jobs.

Packard was acclaimed for having lowered the weight-to-horsepower ratio to 85 pounds.

The car that everyone talked about, though, was the 1904 Peerless tonneau—with a 35-horsepower engine, mind you! Its cylinders were a whopping 4⅜ by 5½ inches. Low—reasonably so, anyhow—and rakish, its "bonnet" stretched for a third of its total length. The whizzer had four forward speeds and a reverse. What's more, it had three brakes. Two, on the drums of the rear wheels, were set by hand; one, on the transmission shaft, was controlled by the owner's proud foot.

Foreign cars, for the first time, had been elbowed into a room off by themselves. The 1904 auto show was a jubilant American performance. "America has caught up with France," a commentator trumpeted, then cautiously muted his tone to, "or, at any rate, she is close at her heels."—*Wesley S. Griswold.*

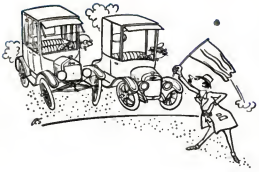


This Way to Popular Science's

1954 AUTO SHOW →

The Race to Watch:

Chevrolet vs. Ford



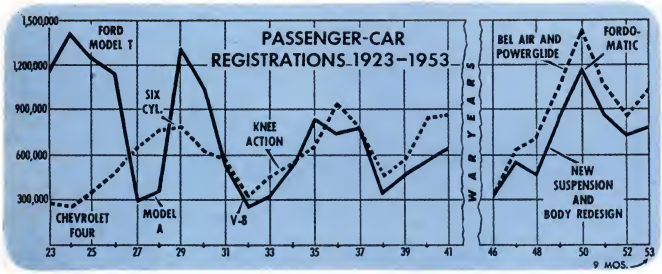
THIS year's most popular make of car is pictured on the facing page.

For 17 years, more customers have planked down their money for Chevrolets than for any other car in the world. Before that, there was a slam-bang battle in which the lead changed hands five times. Before *that,* old Henry sold Model Ts by the millions while Chevvy was still in short pants.

Ever since Henry Ford II took charge, just after the war, the rallying cry of his men has been "Beat Chevrolet!" Ford has poured hundreds of millions of dollars into new plants. Beginning in '49, the car was re-engineered and prettied up. An automatic transmission came out. Ford "raided" GM for engineers and stylists. (At one point Chevvy employees, meeting each other in the corridors, had a stock greeting: "Is Ford in your future?") This year, the first full one of a buyer's market, Ford's entry is showy: slick front suspension, brand-new 130-hp. engine.

But Chevrolet, the long-time champ, hasn't been sleeping. It has the biggest production capacity in the world. That paid off in the years when the market sopped up every car built. Chevvy developed a talent for giving people exactly what they wanted. It beat Ford by a year with an automatic transmission.

The '54 Chevvy comes in an amazing variety of colors and styles, powered by engines stepped up to 115 and 125 hp. Also, before very long, according to Detroit dopesters, Chevvy—like Ford—may take the wraps off its own new engine.



Chevrolet now gets 125 horsepower with a high-lift cam. A wide choice of colors, fabrics and interior appointments tempts the customers this year.

Ford uncorks a new 130-hp. engine, goes to ball-joint suspension. New Skyliner has a fixed plastic top.

Copyrighted material

Buick Super has 182 hp. Like other Buick lines, it sports a new body, wrap-around windshield.

Oldsmobile 88 is one of the lowest '54 cars on the road. Girl beside it stands just over five feet.

Packard convertible is one of eight models in company's luxury line. Engines go up to 212 hp.

Nash has added a four-door station wagon, with optional carrier top, to Rambler line.

Pretty, potent, and with plenty of room to grow—that's the word on Ford's new 130-horsepower OHV prime mover.

SPORTIEST CAR in the line, aside from plastic-domed hardtop on earlier page, is this Sunliner convertible. You can have power brakes and power steering now; air conditioning and factory-installed dual exhausts are rumored to be in the works.

Detroit's Biggest News:

The Ford's New Engine

By Frank Rowsome Jr.
PHOTOS BY W. W. MORRIS

THE story of the '54 Ford is mainly the story of an exciting new chunk of cast iron.

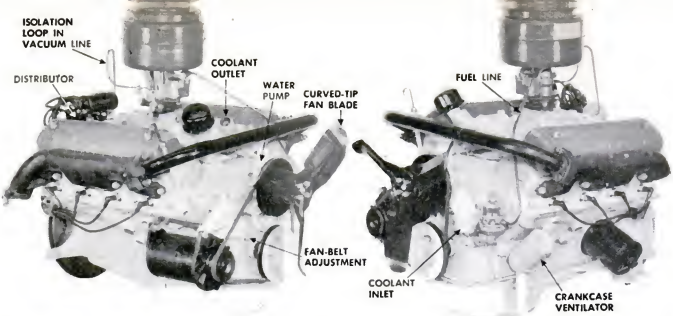
Weighing 570 pounds without its juices, it is a significant hunk of iron. Large numbers of people will know it intimately—its capabilities, appetites, noises and, possibly, weaknesses. Lots of persons will go into hock to buy it. Plenty of guys will give it loving Saturday-morning care (careful you don't burn your wrists on those manifolds trying to get at the plugs), while others won't raise the hood so long as it runs.

Already it has made history by obsoleting the L-head Ford V-8, one of the world's most familiar engines. The L-head, which last year was old enough to vote, had grown from 65 to 110 horsepower at its maker's hands, and to 200-plus under the violent ministrations of the speed-shop set. In certain respects—output, vibration periods, efficiency—it was beginning to show its age. It had been crowded from within the family by Ford's sassy overhead-valve six. Plenty of dirty-hands car enthusiasts will shed a tear for the wonderful old V-8. But if it had to go, as clearly it did, it couldn't have been replaced by a sweeter engine.

What's new? This 130-hp. overhead-valve engine is no engineering face lift on the old job. It is wholly new: new block and heads; new valve train and manifolds; new crank, rods and pistons;

HOW '54 ENGINES COMPARE AMONG THE BIG THREE

Engine	Bore (inches)	Stroke (inches)	Displacement (cu. in.)	Compression Ratio (-to 1)	Power (hp. @ r.p.m.)	Torque (lb. ft. @ r.p.m.)	Horsepower per cu. in.
FORD V-8	3.5	3.1	239	7.2	130 @ 4,200	214 @ 18-2,200	.544
FORD 6	3.62	3.6	223	7.2	115 @ 3,900	193 @ 10-2,200	.516
CHEVROLET 6 (POWERGLIDE)	3.56	3.9	235	7.5	125 @ 4,000	200 @ 2,000	.531
CHEVROLET 6 (STANDARD)	3.56	3.9	235	7.5	115 @ 3,700	200 @ 2,000	.488
PLYMOUTH 6	3.25	4.38	217.8	7.1	100 @ 3,600	177 @ 1,600	.459
'53 FORD V-8 (L-HEAD)	3.19	3.75	239.4	7.2	110 @ 3,800	196 @ 19-2,100	.459

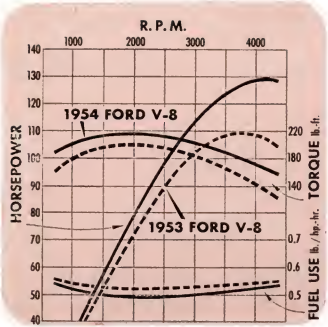


CROSSOVER exhaust pipe is now shorter, bridges top of engine. Dipstick and oil filler are moved to right. The cylinder heads and gaskets will fit on either bank of the engine.

OIL FILTER is a full-flow type, not the kind that just samples a portion of the circulating oil. Crankcase breather is a Lincoln's. In car, a steel skid pad guards bulge of oil pan.

new proportions and performance. Cubic inches and compression have been held the same as in the old engine—but power, torque and efficiency (as reflected in horsepower per cubic inch) have been boosted way up.

How's it go? Like a bat. Slip behind the wheel of a new Ford (you'd have to be an owner or a small boy to tell it from a '53 just by looks) and flip the key. Two red telltales on the new instrument panel light up to signal no oil pressure and no generator output. Give the key a touch of overtravel; the telltales will wink off as she fires up.



POWER AND TORQUE are not only better than in old engine, but gas appetite is less. Ford suspects engine will be hot-rodders' dream; 130-hp. output can be stepped up greatly.

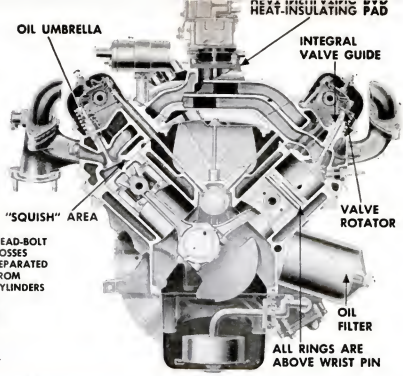
When the engine is warm, jazz the gas judiciously and notice how different it sounds from the old V-8. If you hit the accelerator on the L-head, even a sharply tuned engine would give out a quick "who-me?" gasp before the revs built up. This one climbs up fast, with no preliminary throat clearing.

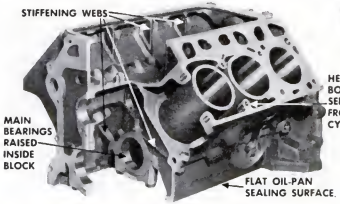
Now take it for a ride. The breakaway is hot—far snappier than the L-head's. If you belt it hard, there's a bit of wheelspin on smooth, dry asphalt; with bumps or car tracks to break the wheels loose, you get spin even at part throttle. Notice that the engine accelerates without that hard-working throb that the L-head put out—it both gets up there quicker and makes less fuss doing it.

The zero-to-60 acceleration time on a manual-shift job averages around 16 seconds. This is a solid three seconds faster than the older Fords turned in, and is substantially better than the main competition. In fact, it is often enough to let you run with such green-light show-offs as Caddy, Olds 88 and Chrysler.

Best breakaway times—if you like to wear out your tires in this curious sport—are racked up with a manual shift and an overdrive (4.10) rear axle, speed-shifted at crossover points of 30 and 50 m.p.h. indicated. Even if you are not a wrist wiz-

CLOSE KINSHIP to the hot Lincoln engine is revealed by sectional view at right. Note that combustion chamber has "squish" area to stir up fuel-air mix as piston comes up. In block below, bosses for head bolts are separated from cylinder walls, to keep the bores from being distorted out of round as head bolts are cinched up tight.





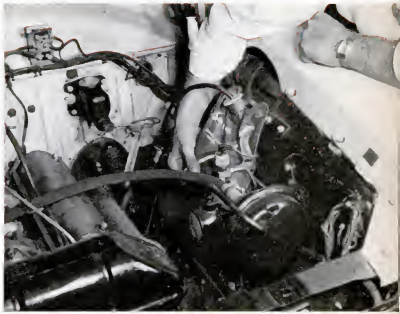
ard or are driving a Fordomatic transmission (using an L-to-D start), time to 60 will still hover around 18½ seconds. This is creditable going in most stock leagues, and will generally keep you from feeling brokenhearted at the light. Top speed, for this writer, averaged out at 96 m.p.h. true, with two two-way runs.

This good performance glistens a lot more in view of the fact that the engine eats less fuel than the L-head did, even though it dishes out 18 percent more power. The OHV job becomes additionally impressive when you realize that it is no handcrafted, lavishly built Special. It is, instead, a machine-made engine, designed for production in immense quantity, for reliability, long life and other homely virtues.

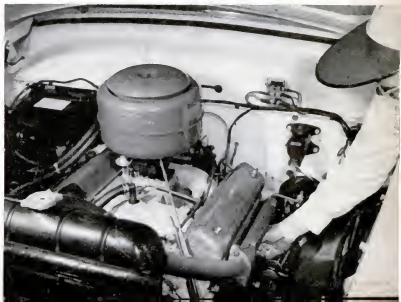
How's it done? Part of the answer lies in the new proportions, part in structure and part in the new valve and combustion-chamber arrangement.

Proportions. Shortening the stroke cuts down on engine friction appreciably, mainly by reducing the distance that piston rings scrub over cylinder walls. Ford engineers have figured that in the L-head, 30 percent of the total output was spent in overcoming internal friction—in civil war. In contrast, they calculate that the OHV loses only 18 percent of its gross power to friction.

Shortening the stroke pays off in cut-



NOT A HOT-WATER BOTTLE, that's a flexible container for windshield-washing fluid. Mechanism in foreground above is Ford's new power brake, an optional extra. There is no vacuum-storage tank, but since brake-pedal travel has not been reduced, driver has normal braking leverage if engine dies. Below, hand shows position of spark plugs—you can take them out easier from underneath.



Rear-quarter recognition features for '54 include black dashes on trim, new trunk latch.

FRENCHED LIGHTS now have little chipmunk cheeks at sides. New ball-joint front suspension, hitherto only on Lincoln, gives better cornering, eliminates rebushing kingpins.

DASH is prettied up in Lincoln manner, and has spot-turned metal background. Speedometer fits in plastic "astro-dome." Ford is holding to a manual choke.

FACTS ON '54 FORD

Model: Mainline four-door sedan.

Engine: V-8 with overhead valves; 130 hp. at 4,200 r.p.m.; compression ratio, 7.2:1; displacement, 239 cu. in.; piston travel (in feet per car mile at 20 m.p.h., manual transmission), 1,505; bore and stroke, 3.5" by 3.1"; torque, 214 lb.-ft. at 1,800 to 2,200 r.p.m.

Weight: 3,405 lb. (approx.); per hp., 26.19.

Transmission: optional torque converter and automatic transmission or three-speed manual transmission with or without overdrive; rear-axle ratio with automatic transmission, 3.54:1.

Steering ratio: 25.3:1 over-all.

Effective brake-lining area: 173.5 sq. in.

Springs: front, coil; rear, semi-elliptic.

Outside dimensions: height, 64.1"; over-all length with bumpers and guards, 198.3"; width, 73.5"; wheelbase, 115.5"; overhang, front 35.1", rear 47.6"; tread, front, 58", rear 56".

Inside dimensions: seat-cushion width, front 58.9", rear 58.9"; leg room, front 42.8", rear 41.5"; headroom, front 35.4", rear 34.2"; seat height, front 13", rear 13.5"; vertical distance, steering wheel to seat cushion with seat in rear position, 5.9"; front-seat adjustment, horizontal 4.1", vertical .3".

Tire size: 6.70 by 15.

ting wear as well as friction. The new engine will travel 21 percent farther down the highway for the same amount of piston travel than the L-head did; or, to turn it around, will show a fifth less bore wear at the same speedometer mileage.

In case you are wondering if stroke-shortening is a magic cure-all, there are of course some drawbacks. One is a somewhat higher engine speed for equivalent output, a point partially canceled by the fact that a short-stroke job is much better suited for faster running. Another disadvantage, in a murky area of internal-combustion theory, is that the gain in mechanical efficiency may be partly offset by loss in thermal efficiency, unless compression is increased, and by slightly increased bearing loads.

Ford engineers won't give an inch on thermal efficiency, though. They assert that the OHV engine is far better than its predecessor in this department, and cite the fact that it needs a smaller cooling system and less copper in the radiator. Cooling in the L-head tended to be critical, as several million drivers have profanely observed. This was partly because there were two water pumps, two thermostats and four hoses to go blooey; but it was still more because exhaust passages ran sideways through each bank of the block, throwing a heavy extra load on the cooling system. The OHV engine is different. It has half the number of pumps, stats, and hoses, and it whisks hot exhaust gases directly out the head, putting far less heat into the block.

Structure. Last August, when Ford engineers showed handmade and pilot-production engines to this writer, the thing they were obviously proudest of was not the flashy performance or the new valve train. It was the structure, which mainly means the block.

Except to members of the fraternity, a block is just an ugly casting with more holes in it than a piece of comic-strip Swiss cheese. To guys in the business, though, a block is basic—it *is* the engine. It governs how much power you can pull,

[Continued on page 268]

Farewell to the L-Head V-8

MANY of the 5,500,000 people who jammed into Ford showrooms across the country on March 31, 1932, were doubtless inflamed with a desire to own a dreamboat like the one above. It cost $460 (bumpers and spare wheel extra), a big piece of change in that third year of the Depression.

What you got for your money was impressive: an honest-to-goodness eight-cylinder car, with 5.5-to-1 compression ratio, an amazing 65 horsepower, and real aluminum pistons. You could order one of 14 bodies in 11 color combinations. Crowning the line was a super de luxe convertible sedan that would set you back $650.

The gasoline tank was tucked back under the rear of the car, and there was a synchronizer to help you shift quietly between second and high. A little hinged door on the dash led to a cubbyhole where you could keep gloves. It was widely rumored—and no Ford salesman denied it—that with this advanced engine you could do better than 75 m.p.h. The acceleration, in that Model A era, was generally held to be almost frighteningly rapid.

From Herbert Hoover to Hot Rods

It was a long way back that these first V-8s appeared: Herbert Hoover was President, Jack Sharkey was heavyweight champ, and the hunt was on for the kidnaper of the Lindbergh baby. In the intervening years this hefty old engine (originally 625 pounds) was quickly debugged and then progressively refined. Oil-consumption and fuel-pump troubles were licked after the first few months. In less than a year the V-8 was outselling its four-cylinder brother by 12 to one.

Horsepower climbed to 75, 85, 90 and ultimately 110; compression moved up to 7.2; and the engine itself grew from 221 to 239 cubic inches. Several generations of kids cut their mechanical eyeteeth on this engine, and they can still remember the sense of excitement, faintly tinged with panic, the first time they took one apart. Before the war, the V-8 had become the hot-rodders' first and favorite love.

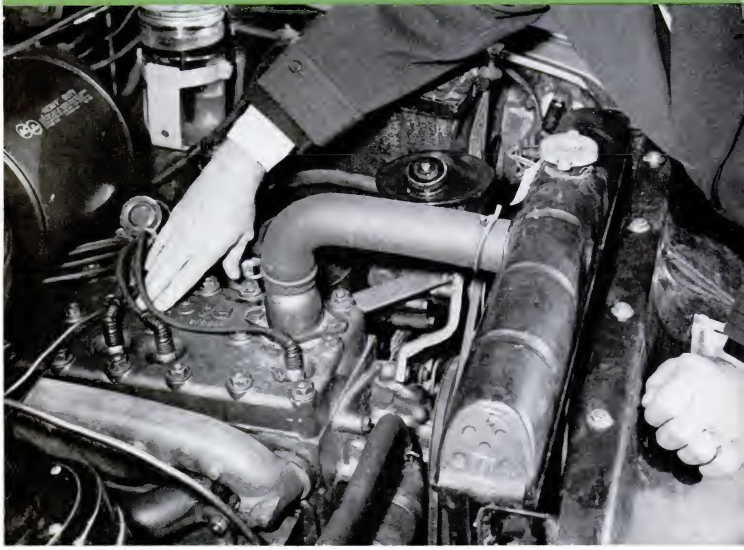
By the time the big Ford engine plants switched over late last fall, some 14,000,000 of these sturdy old goers had been built.

King of the L-Heads:

Packard Hikes Passing Power

THAT'S NO SPOOK following me as I take a luxurious Caribbean for a workout. Instead, it's a '27 sedan that Packard has converted to a towing dynamometer, to give new cars extra work to do. Believe me, it was really quite a pull.

That die-cast aluminum head is velvet-smooth inside and out, stopping carbon build-up.



[illegible] is rough on a [illegible] Patrician bogs down easily. It doesn't.

New aluminum head and the highest compression yet give this big straight-eight brute a whopping torque.

By Wilbur Shaw
President, Indianapolis Motor Speedway

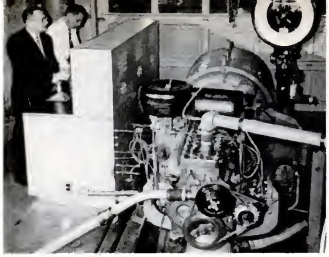
MAXIMUM torque when you need it plus some of the fanciest interiors I've yet seen in any car—that's what Packard has wrapped up for 1954 in its traditionally classic package. The grille is still *the* grille, Packard's familiar radiator shape dating (hold onto your bonnet and goggles) from 1904.

Behind the familiar Packard prows are cars put together after painstaking research into everything from bearskin carpeting to acoustic characteristics of big, flat body panels.

Not long ago I took a new 212-horsepower Patrician around Packard's test track and over their endurance roads to see what they had done to it. They told me that at 8.7 to 1, it had the highest compression ratio in the industry. At more than 4,000 pounds, that Patrician is Packard's biggest stock model and a lot of automobile. When they get that big, you tend to drive sedately—even though the Patrician will easily top a hundred. It's an extremely roomy car with five inches more leg room in the back seat than any other American six-passenger sedan.

It handles smoothly, the way a big boat should. Its power steering is easy but retains a natural feel. Company engineers told me they feel Packard, which was first with the frame-anchored, direct-acting unit, is on the right track. They're confident other firms will be going to the direct-acting setup before long. Clippers also have this system. Their manual ratio of 22.03 compares to a power ratio of 18.2.

Packard's power brakes retain that normal touch, too, with the aid of a reaction diaphragm. I liked the action of



THE BIG LEVER I'm pushing is the throttle of a Packard laboratory dynamometer. The scale at right shows that this big baby is putting out about 330 pound-feet of torque.

DEEP IN SOUND ROOM, an electronic shaker jiggles a hood assembly at various frequencies. Packard test engineer Roy Frailing adjusts oscilloscope that measures the response.

FASTEN YOUR UPPERS for this one. I took that plushy Patrician through once, which was all I wanted. I don't know how the bolts and welds manage to take it, but they do.

the brakes—they're not the touchy kind that slam you into the dash if you forget to gentle them.

With its 1954 cars, Packard is now going full throttle on its drive to recapture the luxury market's first place in sales. Packard lost this position in 1936 to Cadillac. Probably the clearest sign of this race can be seen in the 1954 Packard body. It's about the same as the 1953 body.

In other words, Packard once again will operate on the luxury-car formula: when a man invests in a big car he doesn't want one that will scream "last year" within a few months after his last bank draft has been cleared.

More Models Than Ever Before

Packard is putting a big team into the field. It's the biggest array of models in the company's history. There are three Clippers (Special, De Luxe and Super); two Packards (Cavalier and Patrician), and a Custom line, including the Caribbean sports convertible and some eight-passenger sedans and limousines priced to nearly $7,000.

While the Patrician's engine, a bronze-colored L-head brute, is a remake of Packard's well-known straight-eight, the other three eights for '54 haven't been changed much. Three engines power the remaining Clippers and Packards: 150 and 165 horsepower in the Clippers; 185 horsepower in the Cavalier, smaller of the Packards. Engine 5406, the 212-horsepower job, fires the Patrician and the big Custom cars.

They tell me that Packard edged over the 200-horsepower mark only as a kind of by-product. For the present, at least, they disclaim any part in the horsepower race. But they wanted to drop an engine into their heaviest cars that would give a powerful push on the rear wheels at speeds where it's needed most—between 40 and 70 miles per hour.

They succeeded in getting 17 percent more passing power and 10 percent more horses. The 359-cubic-inch engine now delivers 330 pound-feet of torque at 2,200 r.p.m. That's with Ultramatic trans-

I DON'T KNOW whose grandma embroidered the escutcheon on Balboa's cream-and-scarlet upholstery, but it sure is pretty. Like hex hub, it dates from Packard's early days.

PEEKING UNDER this way is inevitable the first time you see a Balboa hardtop. The bonnet shields the back window, which can be cranked down. It will be powered later.

mission, Packard's torque converter, and represents a road speed of about 51 miles per hour.

The Patrician's new power mainly comes from an amazingly smooth. die-cast aluminum head, shaved down to eliminate breathing dams and topped with a four-barrel carburetor. Intake ports and the camshaft have also been reworked.

Packard has always been engineering-minded. If some recent models have seemed a bit noisier than they should have, you can bet your decibels they'll find out why. One approach to quietness is through proper body-metal design, and another is handled by good insulation. This year Packard is going hard after both.

Current body designs with their great expanses of near-flat metal mean lots of headaches for the people responsible for keeping out the flutters, rattles and buckles. That continental-styled hood, for instance, has only two "draws," the fluting at each side. to give rigidity to the hood panel. Without these it would flap around and bong like your grandmother's cookie sheets or a J. Arthur Rank trademark.

Dash Panel Thickened

Attacking the problem from an insulating standpoint this year, Packard engineers put together certain interior panels with special sound dampers. I saw one dash panel that's a real Dagwood sandwich. It was six layers thick, consisting of 3/32" indented felt. ⅜" jute felt. Kraft paper, .125" to .140" mastic, .090" embossed paper board. and dash-lining carpet. It didn't rattle. END

FACTS ON '54 PACKARD

Model: Packard Patrician 4-door sedan.

Engine: 8-cyl. L-head; 212 hp. at 4,000 r.p.m.; compression ratio, 8.7:1; piston displacement, 359 cu. in.; bore and stroke, 3 9/16" by 4½"; torque, 330 lb.-ft. at 2,200 r.p.m.

Weight: 4,142 lb.; per hp., 19.05.

Transmission: Ultramatic (torque converter, standard equipment), overdrive or standard shift; rear-axle ratio, 3.5:1 with Ultramatic, 4.55:1 with overdrive, 4.1:1 with standard transmission.

Steering ratio: manual 30.9:1, power 22.5:1; radius of turning circle, manual 22.5', power 21.5'.

Effective brake-lining area: 208.25 sq.in.

Springs: front, coil; rear, 5 semi-elliptic leaves, 2½" by 54⅝".

Outside dimensions: height, 62⅝"; overall length with bumpers and guards, 216½"; width, 77⅞"; wheelbase, 127"; overhang, front 35¼", rear 54 3/16"; tread, front 60", rear 60 53/64".

Inside dimensions: seat-cushion width, front 62⅜", rear 62"; leg room, front 43½", rear 48⅜"; headroom, front 36", rear 35¼"; seat height, front 14", rear 14 13/32"; vertical distance, steering wheel to seat cushion, with seat in rear position, 5 1/32"; front-seat adjustment, horizontal 5", vertical 1½".

Tire size: 8.00 by 15.

With Gizmos Galore:

THE SKYLARK

Buick Adds Power and New Series

Special gets V-8 engine and revived Century is one of the hottest cars on the highway.

ON THE new Buicks with power braking and automatic transmissions, there's a little gizmo not much bigger than the chuck on a home-workshop lathe. You could guess until the cows came home what it's there for—until your engine happened to go dead on a long downgrade. Then you'd find out.

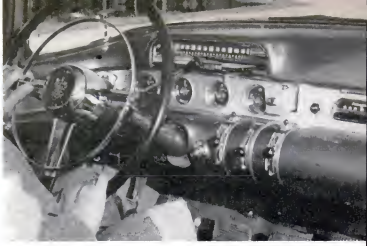
The gizmo is a little electric pump. It pumps nothing but vacuum. If your engine stops, shutting off the manifold vacuum supply to the brakes, the pump starts. Powered by Buick's 12-volt battery, it supplies emergency vacuum for power braking. The electric vacuum

By Devon Francis

THE SUPER RIVIERA

AT 85 M.P.H., Buick's 1954 Super sedan takes a curve on GM proving ground's high-speed lane. Car's 182 hp. developed an average true speed of 101 m.p.h. in straightaway runs with and against the wind.

WRAP-AROUND WINDSHIELDS and door hinging create this aperture when front doors are opened. Entrance is easier this year because of added foot room.



HORIZONTAL SPEEDOMETER and double roll-type panel are most striking interior changes. Extra blower on ventilation system provides fresh air on hot days.

MODIFIED FISHTAIL is feature of rear fenders. All convertible and hardtop models have high rear-fender wheel cutouts. Trunk opening measures 34″ by 58″.

VISIBILITY INCREASE for driver with wrap-around windshield is almost 20 percent. Air scoop, moved to cowl from grille, avoids intake of exhaust fumes.

pump is only one gizmo in a considerable list of gizmos and changes for 1954. Here's a run-down:

- An engine change supplying more horsepower in all the new Buicks.
- A crossbreeding of two series of cars to produce a brand-new series that may well outperform any standard U. S. automobile below the so-called luxury class.
- A spanking-new V-8 engine for the sturdy little Special.
- Bodies that are all new, clear across the board, for the first time in 18 years.
- A new type of speedometer that works like a revolving barbershop pole.

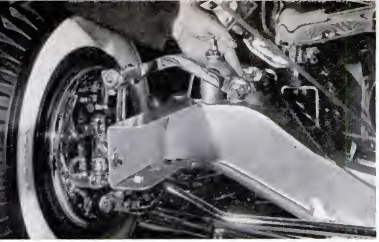
Buick horsepowers have climbed. The big Roadmaster series is now rated at 200, compared with last year's 188. The Super, with Dynaflow transmission, is up from 170 to 182.

And then there's that crossbred job, the Century line. Buick last manufactured the Century, as a series name, back in 1942. This year's Century—priced between the Special and the Super—is the Special in all but engine. There it packs the Roadmaster's wallop.

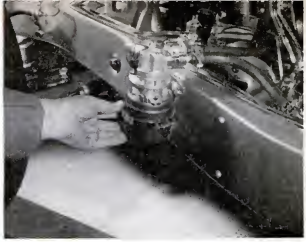
Special Is Brought Up to Date

The other day at the GM proving ground a Century gave a 1953 Super a head start of a tenth of a mile and passed it a bare half-mile from its own take-off point.

The Special's new V-8 engine kills off the last of Buick's famous old valve-in-head straight eights. In 1953 the big Roadmaster and the Super were coiffured for V-8s. This year it was the Special's turn. Buick took the same block used in its other series of cars and bored smaller holes for cylinders.

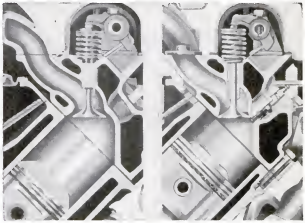


AIRPLANE-TYPE SHOCKS on front suspension replace lever type. Wheelbase is up 5½ inches on Super and Roadmaster two-doors, a fraction of an inch on Special.



ELECTRIC MOTOR mounted on left side of frame supplies emergency vacuum for power brakes. It responds to engine speed by reading the generator voltage.

SPEEDOMETER, with case off, shows how spiraled drum—looking like barber shop pole—creates creeping red line on horizontally graduated face to indicate speed. Covering on drum is rectangular sheet of paper painted half red, half black on the diagonal. As drum revolves, red part moves up or down, giving effect of going to right or left. Drive unit is conventional—a magnet revolved by a cable that is attached to drive shaft.



BOOST IN POWER is due partly to redesigning crown of piston. Old crown (left) was higher. New one (right) supplies less "squish area," better burning.

But the Special's head and stroke are identical with those of the other series. Its horsepower is up to 150 from 130, and the engine, with an automatic transmission, is 68 pounds lighter—with practically the same piston displacement as the old in-line.

[Continued on page 274]

FACTS ON '54 BUICK

Model: Super 4-door sedan.

Engine: OHV V-8; 182 hp. at 4,100 r.p.m.; compression ratio, 8.5:1; piston displacement, 322 cu. in.; piston travel (in feet per car mile at 20 m.p.h.), 1,334; bore and stroke, 4" by 3.2"; crankshaft bearing surface, 52.8 sq. in.; torque, 300 lb.-ft. at 2,000 r.p.m.

Weight: 4,020; per hp., 22.1 lb.

Transmission: Dynaflow (torque converter); rear-axle ratio, 3.4:1.

Steering ratio: 24.1:1 (power); 26.7:1 (mechanical); radius of turning circle, 21.5'.

Effective brake-lining area: 207.5 sq. in.

Springs: coils all around.

Outside dimensions: height, 62.4"; overall length with bumpers and guards, 216.8"; width, 79.9"; wheelbase, 127"; overhang, front 36.3"; rear 53.5"; tread, front 59", rear 62.2".

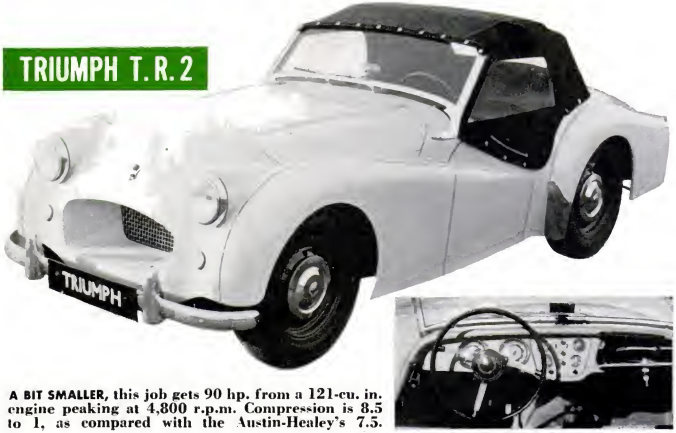
Inside dimensions: seat-cushion width, front 64.8", rear 65.9"; leg room, front 43.4", rear 44.2"; seat height, front 13.5", rear 12.6"; vertical distance, steering wheel to seat cushion, taken on arc, 4.7"; front-seat adjustment, horizontal 4.7", vertical 1.1".

Tire size: 7.60 by 15.

WIRE-SPOKE, KNOCK-ON WHEELS are standard, as are twin carbs, tachometer and a British type of overdrive. Engine is an OHV four of about 162 cu. in.

You'll see more of these Two Sports Imports

THE U. S. market for sports cars, peanuts by Detroit standards, still seems juicy to the British. Here are two new entries, aimed at the price and performance gap between the MG and the Jaguar. Both can better 100 m.p.h. and, with 90 horsepower to tote less than a ton, can climb up to 60 in 11 seconds. They corner well, let a driver shift happily, and are comfortable enough to avoid that camping-out feeling. Prices in New York: $2,985 for the Austin-Healey, $2,345 for the Triumph T.R.2.



A BIT SMALLER, this job gets 90 hp. from a 121-cu. in. engine peaking at 4,800 r.p.m. Compression is 8.5 to 1, as compared with the Austin-Healey's 7.5.

Notes and Comments on

ON THE following two pages the principal specifications of U. S. cars for 1954 are tabulated. The cars listed are four-door sedans. Some figures —such as over-all length, weight and seat-cushion widths—will vary somewhat in different models, generally increasing with the cost.

SERIES. With some makes, the series or lines are mechanically identical but differ in trim, appointments and body styles. Examples: Chevrolet. Ford. In other cases, the lines also differ in engine, transmission and wheelbase. Examples: Buick, Nash. The following pages show major mechanical variations available on all lines.

HORSEPOWER AND TORQUE. These are rough indices of breakaway, highway acceleration and top speed, and are almost universally higher this year. The revs at which power and torque peaks occur are also a little higher.

DISPLACEMENT. This is the best measurement of the size of an engine. Roughly, the more inches, the more engine.

COMPRESSION AND FUEL REQUIREMENT. Almost all U.S. cars will function on regular gas if the timing is degraded sufficiently. But a good many won't be happy unless fed a diet of premium gasoline, and timed to suit. The fuel requirement shown is the maker's recommendation, and is the fuel used to produce the rated power and torque.

Engines listed as needing only regular fuel will often give slightly higher output on premium fuel *provided* timing is slightly modified.

OVER-ALL LENGTH. Since this includes bumpers and bumper guards, it shows if that new job will fit in your garage.

WHEELBASE. This is the "dynamic length" of a car, and discounts any hanging gardens that stylists may have planted at front and rear. Current opinion is that a long wheelbase will ride better, a short one will corner better.

STEERING RATIO. The higher the numerical ratio, the "slower" the steering —the more you have to turn the wheel to produce a change in direction. Ratios are coming down somewhat as power steering grows more popular.

EFFECTIVE BRAKE-LINING AREA. Stopping power grows more vital as horsepower and highway speeds climb. Lining area reflects both pure braking ability and also probable resistance to "fade"—that terrifying failure of overused brakes.

REAR-AXLE RATIO. Most manufacturers offer a selection of ratios. Which one you get is principally governed by the transmission you select, and sometimes by body weight. However, you may have an option on small variations, depending on whether you drive on flat or hilly country, and on whether you prize performance or economy. The higher the ratio, numerically, the more the engine turns in relation to the rear wheels. Overdrive, when engaged, has the effect of lowering the numerical ratio of the rear end.

POUNDS PER HORSEPOWER. The lower this figure, the more "jump" a car will have at getaway and passing.

HORSEPOWER PER CUBIC INCH. This is a rough measurement of engine efficiency; a high value here means that a power plant puts out more for its size.

PISTON TRAVEL. This is an approximate guide to wear: the lower the figure, the less wear accumulated per mile.

POUNDS PER SQUARE INCH OF BRAKE LINING. This figure mirrors how hard each inch of lining must work.

Car Score Card for '54

ENGINE SPECIFICATIONS

		TYPE OF ENGINE	MAXIMUM BRAKE HORSEPOWER AT WHAT ENGINE SPEED (Horsepower; r.p.m.)	MAXIMUM TORQUE AT WHAT ENGINE SPEED (Pound-feet; r.p.m.)	BORE AND STROKE (Inches)	DISPLACEMENT (Cubic Inches)	COMPRESSION RATIO (to 1)	FUEL REQUIREMENT (Regular or Premium)	COOLING-SYSTEM CAPACITY (Quarts)	CURB WEIGHT (Pounds)	OVER-ALL LENGTH (Feet & Inches)
BUICK	SPECIAL (Series 40)	OHV V-8	143 @ 4,200[a]	228 @ 2,400	3.63 x 3.2	264	7.2	Regular	18	3,714[d]	17' 2¼"
	CENTURY (Series 60)	OHV V-8	195 @ 4,100[b]	302 @ 2,400	4 x 3.2	322	8	Premium	18	3,786[d]	17' 2¼"
	SUPER (Series 50)	OHV V-8	177 @ 4,100[c]	295 @ 2,000	4 x 3.2	322	8	Premium	18	4,020[d]	18' ¾"
	ROADMASTER (Series 70)	OHV V-8	200 @ 4,100	309 @ 2,400	4 x 3.2	322	8.5	Premium	20	4,212[d]	18' ¾"
CADILLAC	62 SERIES	OHV V-8	230 @ 4,400	332 @ 2,800	3.81 x 3.63	331	8.25	Premium	22	N.A.	18' ⅜"
	60 SERIES	OHV V-8	230 @ 4,400	332 @ 2,800	3.81 x 3.63	331	8.25	Premium	22	N.A.	18' 11⅜"
	75 SERIES	OHV V-8	230 @ 4,400	332 @ 2,800	3.81 x 3.63	331	8.25	Premium	24.5	N.A.	19' 9¼"
CHEVROLET	150, 210, BEL AIR } {Manual Shift / Powerglide	OHV 6	115 @ 3,700	200 @ 2,000	3.56 x 3.94	235	7.5	Regular	16	3,360	16' 4"
		OHV 6	125 @ 4,000	200 @ 2,000	3.56 x 3.94	235	7.5	Regular	16	3,485	16' 4"
CHRYSLER	WINDSOR DELUXE	L-head 6	119 @ 3,600	218 @ 1,600	3.44 x 4.75	264.5	7	Regular	16	3,685[d]	17' 11⅝"
	NEW YORKER	OHV V-8	195 @ 4,400	320 @ 2,000	3.81 x 3.63	331.1	7.5	Regular	26	3,955[d]	17' 11⅝"
	NEW YORKER DELUXE	OHV V-8	235 @ 4,400	330 @ 2,600	3.81 x 3.63	331.1	7.5	Regular	26	4,060[d]	17' 11⅝"
	CUSTOM IMPERIAL	OHV V-8	235 @ 4,400	330 @ 2,600	3.81 x 3.63	331.1	7.5	Regular	26	4,345[d]	18' 7¾"
DE SOTO	POWERMASTER	L-head 6	116 @ 3,600	208 @ 1,600	3.44 x 4.5	250.6	7	Regular	16	3,682[d]	17' 10½"
	FIRE OOME	OHV V-8	170 @ 4,400	255 @ 2,400	3.63 x 3.34	276.1	7.5	Regular	23	3,934[d]	17' 10½"
DODGE	MEADOWBROOK & CORONET 6	L-head 6	110 @ 3,600	190 @ 1,600	3.25 x 4.62	230.2	7.25	Regular	15	3,350[e]	17' 1½"
	MEADOWBROOK & CORONET 8	OHV V-8	140 @ 4,400	220 @ 2,000	3.44 x 3.25	241.3	7.1	Regular	20	3,525[e]	17' 1½"
	ROYAL	OHV V-8	150 @ 4,400	222 @ 2,400	3.44 x 3.25	241.3	7.5	Regular	20	3,565	17' 1½"
FORD	MAINLINE, CUSTOMLINE, CRESTLINE }	OHV 6	115 @ 3,900	193 @ 1,000-2,200	3.62 x 3.6	223	7.2	Regular	16	3,275	16' 6¼"
		OHV V-8	130 @ 4,200	214 @ 1,800-2,200	3.5 x 3.1	239	7.2	Regular	21	3,405	16' 6¼"
HUDSON	JET & SUPER JET	L-head 6	104 @ 4,000[k]	158 @ 1,400	3 x 4.75	202	7.5	Regular	16	2,875	15' ⅜"
	WASP	L-head 6	126 @ 4,400	178 @ 2,400	3.56 x 3.88	232	7	Regular	19.5	3,674	16' 9½"
	SUPER WASP	L-head 6	140 @ 4,000[l]	214 @ 1,600	3.56 x 4.38	262	7	Regular	19.5	3,749	16' 10½"
	HORNET	L-head 6	168 @ 3,800[m]	264 @ 1,800	3.81 x 4.5	308	7.5	Regular	19.5	3,838	17' 4⅞"
LINCOLN	LINCOLN, CAPRI }	OHV V-8	205 @ 4,200	305 @ 2,300-3,000	3.8 x 3.5	317	8	Premium	22.5	4,310	17' 10¾"
MERCURY	MERCURY, MONTEREY }	OHV V-8	161 @ 4,400	238 @ 2,200-2,800	3.62 x 3.1	256	7.5	Regular	20	3,613	17' 2¼"
NASH	RAMBLER 2-Door[p]	L-head 6	85 @ 3,800	150 @ 1,600	3.13 x 4	184	7.25	Regular	12	2,550[d]	15' 5⅜"
	RAMBLER 4-Door	L-head 6	90 @ 3,800	150 @ 1,600	3.13 x 4.25	195.6	7.3	Regular	12	2,650[d]	16' 1⅜"
	STATESMAN	L-head 6	110 @ 4,000	155 @ 2,000	3.13 x 4.25	195.6	8.5	Regular	15	3,045[d]	16' 10¼"
	AMBASSADOR	OHV 6	130 @ 3,700[q]	220 @ 1,600	3.5 x 4.38	252.6	7.6[q]	Regular[r]	18	3,430[d]	17' 5¼"
OLDSMOBILE	88	OHV V-8	170 @ 4,000	300 @ 2,000	3.88 x 3.44	324.3	8.25	Premium	21.5	3,952	17' 1¼"
	SUPER 88	OHV V-8	185 @ 4,000	300 @ 2,000	3.88 x 3.44	324.3	8.25	Premium	21.5	3,994	17' 1¼"
	98	OHV V-8	185 @ 4,000	300 @ 2,000	3.88 x 3.44	324.3	8.25	Premium	21.5	4,108	17' 10¼"
PACKARD	SPECIAL	L-head 8	150 @ 4,000	260 @ 2,200	3.5 x 3.75	288	7.7	Premium	19.9	N.A.	17' 11½"
	SUPER & DELUXE	L-head 8	165 @ 3,600	295 @ 2,200	3.5 x 4.25	327	8	Premium	19.9	N.A.	17' 11½"
	CAVALIER	L-head 8	185 @ 4,000[s]	310 @ 2,200	3.5 x 4.25[t]	327[t]	8	Premium	19.9	N.A.	18' ½"
	PATRICIAN	L-head 8	212 @ 4,000	330 @ 2,200	3.56 x 4.5	359	8.7	Premium	19.9	N.A.	18' ½"
PLYMOUTH	PLAZA	L-head 6	100 @ 3,600	177 @ 1,600	3.25 x 4.37	217.8	7.1	Regular	14	3,135	16' 1½"
	SAVOY	L-head 6	100 @ 3,600	177 @ 1,600	3.25 x 4.37	217.8	7.1	Regular	14	3,185	16' 1½"
	BELVEDERE	L-head 6	100 @ 3,600	177 @ 1,600	3.25 x 4.37	217.8	7.1	Regular	14	3,200	16' 1½"
PONTIAC	CHIEFTAIN SPECIAL	L-head 6[u]	116 @ 3,800[v]	193 @ 2,000	3.56 x 4	239.2	7	Regular[x]	20.1	3,381[d]	16' 10⅝"
	CHIEFTAIN DELUXE	L-head 8[u]	122 @ 3,800[w]	226 @ 2,200	3.33 x 3.75	268.4	6.8	Regular[x]	20.6	3,456[d]	16' 10⅝"
	STAR CHIEF	L-head 8	127 @ 3,800	226 @ 2,200	3.33 x 3.75	268.4	7.7	Regular[x]	20.6	3,735[d]	17' 9⅝"
STUDEBAKER	CHAMPION	L-head 6	85 @ 4,000	138 @ 2,400	3 x 4	169.6	7.5	Regular	11.5	2,900	16' 6⅝"
	COMMANDER, LANO CRUISER }	OHV V-8	120 @ 4,000	190 @ 2,000	3.38 x 3.25	232.6	7.5	Regular	18.75	3,266	16' 6⅝"[y]

[a] *150 hp. with 8.1 compression;* [b] *200 hp. with 8.5 compression;* [c] *182 hp. with 8.5 compression;* [d] *Shipping weight without gas or water;* [e] *3.36 optional; standard on air-conditioned models;* [f] *Either engine-and-transmission combination available on all series;* [g] *3,380 lb. for Coronet 6; 3,555 lb. for Coronet 8;* [h] *3.9 on Coronet 8;* [i] *7.10 by 15 on Coronet 6;* [j] *Either engine and any transmission available on all series;* [k] *114 hp. with twin carburetors;* [l] *149 hp. with twin carburetors;* [m] *170 hp. @ 4,000 with twin carburetors;* [n] *6.40 by 15 on Super Jet;* [o] *24.78 lb./hp. on Jet with twin carburetors;* [p] *Two-door models with auto. trans.*

BODY AND CHASSIS SPECIFICATIONS — PERFORMANCE FACTORS

WHEELBASE (Inches)	STEERING RATIOS (to 1) Manual	STEERING RATIOS (to 1) Power	EFFECTIVE BRAKE-LINING AREA (Square Inches)	TRANSMISSION TYPES AVAILABLE	REAR-AXLE RATIOS (to 1) Manual	REAR-AXLE RATIOS (to 1) Overdrive	REAR-AXLE RATIOS (to 1) Automatic	TIRE SIZE	TURNING-CIRCLE DIAMETER (Feet & Inches)	SEAT-CUSHION WIDTHS (Inches) Front	SEAT-CUSHION WIDTHS (Inches) Rear	WEIGHT PER HORSEPOWER (Pounds)	HORSEPOWER PER CUBIC INCH	PISTON TRAVEL (Feet per Car Mile at 20 m.p.h. With Wheat Transmission)	WEIGHT PER SQUARE INCH OF BRAKE LINING (Pounds)	DETAILS IN POPULAR SCIENCE MONTHLY (Month and Page)
122	26.7	24.1	184.6	Man.; Auto.	3.9	—	3.6	7.60 x 15	41' 3⅝"	62.4	62.5	25.97	.542	1,408 Auto.	20.12	Feb. p. 146
122	26.7	24.1	207.5	Man.; Auto.	3.9	—	3.4	7.60 x 15	41' 3⅝"	62.4	62.5	19.42	.606	1,331 Auto.	18.25	
122	26.7	24.1	207.5	Man.; Auto.	3.9	—	3.4	7.60 x 15	43'	64.8	65.9	22.71	.550	1,334 Auto.	19.37	
127	N.A.	24.1	219	Automatic	—	—	3.4	8.00 x 15	43'	64.8	65.9	21.06	.621	1,398 Auto.	19.23	
129	N.A.	21.5	211.6	Automatic	—	—	3.07[a]	8.00 x 15	N.A.	64.3	65.2	N.A.	.695	1,328 Auto.	N.A.	Feb. p. 154
133	N.A.	21.5	211.6	Automatic	—	—	3.07[a]	8.00 x 15	N.A.	64.3	65.2	N.A.	.695	1,328 Auto.	N.A.	
149 4/5	N.A.	21.5	211.6	Automatic	—	—	3.77	8.20 x 15	55'	64.1	59.4	N.A.	.695	1,608 Auto.	N.A.	
115	23.1	22.1	158	Manual	3.7[b]	—	—	6.70 x 15	37'	59.9	60.5	29.22	.488	1,816 Man.	21.27	Jan. p. 122
115	23.1	22.1	158	Automatic	—	—	3.55	6.70 x 15	37'	59.9	60.5	27.88	.531	1,742 Auto.	22.06	
125½	25.8	16.2	201	Man.; Auto.	3.9	—	3.73	7.60 x 15	41' 9"	61.5	60.125	30.97	.450	2,200 Man.	18.33	Nov. p. 99
125½	25.8	16.2	201	Automatic	—	—	3.36	8.00 x 15	43' 6"	61.5	60.125	20.28	.589	1,420 Auto.	19.68	
125½	25.8	16.2	201	Automatic	—	—	3.36	8.00 x 15	43' 6"	61.5	60.125	17.28	.710	1,420 Auto.	20.20	
133½	25.8	16.2	201	Automatic	—	—	3.54	8.20 x 15	N.A.	61.5	59.75	16.49	.710	1,475 Auto.	21.62	
125½	23	16.2	201	Man.; OD; Auto.	3.9	4.3	3.73	7.60 x 15	N.A.	61.5	60.125	31.74	.463	2,090 Man.	18.32	Dec. p. 157
125½	25.8	16.2	201	Man.; OD; Auto.	3.73	4.1	3.54	7.60 x 15	N.A.	61.5	60.125	23.14	.616	1,485 Man.	19.57	
119	21.4	20.4	158	Man.; OD; Auto.	3.9	4.3	3.73	6.70 x 15[i]	41' 5"	60.625	60.5	30.45	.478	2,220 Man.	21.20	Nov. p. 104
119	21.4	20.4	173.5	Man.; OD; Auto.	3.73[h]	4.1	3.54	7.10 x 15	41' 5"	60.625	60.5	25.18	.580	1,465 Man.	20.32	
119	21.4	20.4	173.5	Man.; OD; Auto.	3.9	4.1	3.54	7.10 x 15	41' 4"	58.5	58	23.77	.622	1,530 Man.	20.55	
115½	25.3	25.3	173.5	Man.; OD; Auto.	3.9	4.1	3.31	6.70 x 15	41'	58.9	58.9	28.48	.516	1,484 Auto.	18.92	Feb. p. 136
115½	25.3	25.3	173.5	Man.; OD; Auto.	3.9	4.1	3.54	6.70 x 15	41'	58.9	58.9	26.19	.544	1,366 Auto.	19.67	
104⅜	20	20	132.1	Man.; OD; Auto.	4.1	4.27	3.54	5.90 x 15[n]	39' 4"	58	58	27.64[o]	.515	1,440 Auto.	21.76	Oct. p. 172
119	20.2	20.2	140.4	Man.; OD; Auto.	4.09	4.55	3.07	7.10 x 15	40' 6"	64	64	29.16	.543	1,670 Auto.	26.17	
119⅞	20.2	20.2	140.4	Man.; OD; Auto.	4.09	4.55	3.07	7.10 x 15	40' 6"	64	64	26.78	.534	1,626 Auto.	26.70	
123⅞	25.6	25.6	158.7	Man.; OD; Auto.	4.09	4.55	3.07	7.10 x 15	40' 7"	64	64	22.85	.545	2,140 Auto.	24.18	
123	26.1	21.3	220.1	Automatic	—	—	3.31	8.00 x 15	45' 8⅜"	62.3	62.1	21.02	.647	1,380 Auto.	19.58	Jan. p. 143
118	25.4	25.4	159.1	Man.; OD; Auto.	3.91	4.09	3.54	7.10 x 15	40' 11⅜"	58.9	58.9	22.44	.629	1,380 Auto.	22.72	Jan. p. 152
100	19.5	N.A.	92.1[r]	Man.; OD; Auto.	3.77	4.4	3.3	6.40 x 15	42' 9"	58	45.25	30	.462	1,792 Man.	27.69	Dec. p. 152
108	19.5	N.A.	104.3	Man.; OD; Auto.	3.77	4.4	3.3	6.40 x 15	42' 2"	60	59.5	29.44	.460	1,792 Man.	25.41	
114¼	24.1	24.1	150	Man.; OD; Auto.	4.4	4.9	3.6	6.70 x 15	44' 6"	65	64.5	27.68	.561	1,794 OD	20.30	
121¼	25.5	25.5	172	Man.; OD; Auto.	4.1	4.4	3.15	7.10 x 15	45' 10"	65	64.5	26.38	.514	1,670 Auto.	19.94	
122	27.5	25.7	191.7	Man.; Auto.	3.42	—	3.07	7.60 x 15	42' 6"	62.3	62.5	23.25	.525	1,261 Auto.	20.62	Feb. p. 157
122	27.5	25.7	191.7	Man.; Auto.	3.42	—	3.23	7.60 x 15	42' 6"	62.3	62.5	21.59	.571	1,325 Auto.	20.83	
126	27.5	25.7	191.7	Man.; Auto.	3.42	—	3.23	7.60 x 15	43'	62.3	62.5	22.21	.571	1,331 Auto.	21.42	
122	27.3	22	198.8	Man.; OD; Auto.	3.9	4.1	3.54	7.60 x 15	43'	62.8	62	N.A.	.521	N.A. —	N.A.	Feb. p. 142
122	27.3	22	198.8	Man.; OD; Auto.	3.9	4.1	3.23	7.60 x 15	43'	62.8	62	N.A.	.505	N.A. —	N.A.	
127	30.9	22.5	208.25	Man.; OD; Auto.	3.9	4.1	3.54	8.00 x 15	45'	62.8	62	N.A.	.566	N.A. —	N.A.	
127	30.9	22.5	208.25	Man.; OD; Auto.	4.1	4.55	3.54	8.00 x 15	45'	62.8	62	N.A.	.591	N.A. —	N.A.	
114	21.1	19.7	158	Man.; OD; Auto.	3.73	4.1	3.73	6.70 x 15	39'	59.75	58.75	31.35	.459	2,010 Man.	19.84	Nov. p. 104
114	21.1	19.7	158	Man.; OD; Auto.	3.73	4.1	3.73	6.70 x 15	39'	59.75	58.75	31.85	.459	2,010 Man.	20.16	
114	21.1	19.7	158	Man.; OD; Auto.	3.73	4.1	3.73	6.70 x 15	39'	59.75	58.75	32	.459	2,010 Man.	20.25	
122	25	23.3	171	Man.; Auto.	4.1	—	3.07	7.10 x 15	43' 6"	59.8	60.7	29.15	.485	N.A. —	19.77	Jan. p. 120
122	25	23.3	171	Man.; Auto.	3.9	—	3.07	7.10 x 15	43' 6"	59.8	60.7	28.33	.455	N.A. —	20.21	
124	25	23.3	171	Man.; Auto.	3.9	—	3.23	7.10 x 15	45'	59.8	60.7	29.41	.474	1,481 Auto.	21.84	
116½	—[s]	20	166	Man.; OD; Auto.	4.1	4.56	4.1	6.40 x 15	38' 6"	59.5	59	34.12	.500	2,107 Man.	17.47	Dec. p. 110
116½[y]	—[s]	20	195.3	Man.; OD; Auto.	4.09	4.27	3.54	7.10 x 15	38' 6"	59.5	59	27.22	.515	1,636 Man.	16.72	

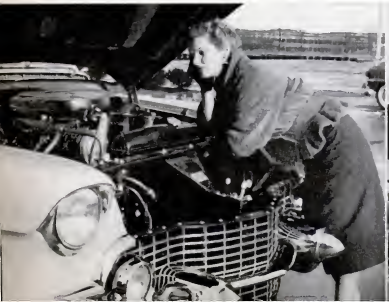
have 195.6-cu.-in. engine with 7.3 compression; [a]140 hp. @ 4,000 with 8 compression; premium fuel recommended; [r]104.3 sq. in. with auto. trans.; [s]212 hp. @ 4,000 with 8.7 compression; [t]Patrician engine used in some Cavalier models; [u]Eisher 6 or 8 available on either Chieftain series; [v]118 hp. @ 3,800 with 7.7 compression for auto. trans.; [w]127 hp. @ 3,800 with 7.7 compression for auto. trans.; [x]Premium with high-compression head for auto. trans.; [y]Hardtop coupe and Land Cruiser are 4" longer; [z]Variable-ratio steering gear. NOTE: Where N.A. appears above, the figures were not available at press time.

AS THE COUPE DE VILLE CADDY was shoehorned out, Janet stood by anxiously.

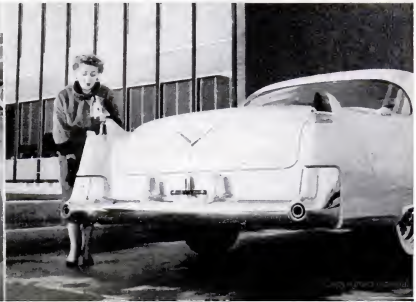
THE FIRST COMPLETELY NEW CADDY since 1950, wheelbase is up three inches, height down a half-inch, over the '53 (shown on the left). But length is the same. Air-vent inlets are now in the cowl. Restyled grille and longer "eyelids" caught Janet's attention.

Something to Whistle at:

THE V-8 ENGINE—Greek to her—has 230 horsepower, 20 more than last year. Removing the spring expander from the oil ring and chroming the top compression ring reduced friction and cylinder wear. The new starter's so quiet you can't hear it.



CADDY'S HIDDEN-GAS-CAP TRICK was new to Janet. The twin exhaust ports in the rear bumper are round this year. The greater width of the rear window is no optical illusion—it's 100 square inches larger. Wider rear spring leaves soften the ride.



Lovely Janet Hoffmann gives a model's-eye view of one of the world's most luxurious automobiles.

THE pretty girl in the photographs is 23-year-old, ash-blonde Janet Hoffmann. We telephoned her at her Detroit home the other day to ask how she would like to drive a 1954 Cadillac.

Her response was a ladylike squeal.

The story of the new Caddy is reflected in Janet's reaction to it.

A professional model, Janet has been glamorizing automobiles, tooth paste and nightgowns for photographers since 1949. For this tour in front of the camera we told her to just be herself.

"Okay," she said. "no glamour."

How well she succeeded in presenting a de-glamorized appearance with one of the world's most glamorous cars is left to the reader to decide.—*Devon Francis.*

"What's this thing for?"

A RAIN MOLDING over the windows lets you open them slightly for ventilation without getting wet. Janet was surprised to learn that while Caddy makes the most expensive U.S. luxury car—an $8,000 convertible—its Series 62 coupe is only $3,575.

"Oooh, that fabric!"

AND OOOH, THOSE SEATS—two inches wider. That instrument panel in front has a top that comes off. That's so a mechanic can work on the machinery right side up. Caddy has new power brakes with a high pedal to "fail safe." ***(Continued on the next page.)***

"What a windshield!"

WRAPPED AROUND, it gives front-seaters a look out the side. Windshield washers, standard equipment, are automatic: push a button, the water squirts out and the wipers start. After the water shuts off, the wipers swing six more times and then stop.

"The heat comes out there."

TWO HEATING SYSTEMS, one for the front seat, one for the rear, keep passengers warm. Heat for the rear seat is piped through the body and through louvers located at the leading edge of the door when it's closed. It flows out of the door at the sill line.

"You turn this for cool air."

AN AUXILIARY CONTROL for the air-conditioning system is on the package shelf in the rear. One of the two air intakes is in the foreground. A clutch disconnects the compressor on the engine when the cooling system is shut off, saving power and wear.

"Whee! Feel that getaway!"

IT'S SMOOTHER, TOO. The front wheels were moved out slightly and the engine lowered. That let Caddy engineers straighten out the drive shaft, giving the universal joints less to do. The result of these modifications is an almost complete absence of vibration.

FACTS ON '54 CADILLAC

Model: Coupe de Ville (Series 62).

Engine: OHV V-8; 230 hp. at 4,400 r.p.m.; compression ratio, 8.25:1; piston displacement, 331 cu. in.; piston travel (in feet per car mile), 1,328; bore and stroke, 3 13/16" by 3¾"; torque, 332 lb.-ft. at 2,800 r.p.m.

Weight: (shipping) 4,395 lb. (est.); per hp., 19 lb. (est.).

Transmission: Hydra-Matic; rear-axle ratio, 3.07:1.

Steering ratio: 21.5 with power steering (standard equipment); radius of turning circle, 23.5' (est.).

Effective brake-lining area: 211.6 sq. in.

Outside dimensions: height, 59.7"; overall length, 223.4"; width, 80.1"; wheelbase, 129"; overhang, front 34.9", rear 59.5"; tread, front 60", rear 63.1".

Inside dimensions: seat-cushion width, front 63.9", rear 56.4"; leg room, front 43.2", rear 41.4"; headroom, front 34.3", rear 34.4"; seat height, front 14.9", rear 12"; vertical distance, steering wheel to seat cushion, with seat in mid-position, 5.4"; front-seat adjustment (electric), horizontal 4", vertical 1".

Tire size: 8.00 by 15.

Real Lowdown:

New Olds Hugs Road

Rakish fenders, racy lines and a 20-horsepower boost in all models distinguish GM's "middle car" for '54.

By Kenneth Wylie

YEARS past, such cars as the American Underslung, Ruxton and Cord have snatched their low chassis over U. S. highways. The 1954 Oldsmobile is right in this racy tradition.

But there's a difference. The car is low—and it isn't. Low-slung automobiles of the past often have been just that: low-*slung*. The new Olds is not. It looks lower, and, in fact, the body is down 3 1/10 inches. But running gear has stayed up where it was.

Its ground-hugging appearance has been subtly achieved by stylists and engineers who wanted to give the car better looks and road-holding qualities while saving Olds' buyers from the demonic racket caused by road-dinged flywheel covers and differential housings.

New pavement-to-roof height of all three Olds models is just 60½ inches. Once the engineers decided lowness would be the accent for 1954, they knew several roads were open to them:

They could take up all the shrinkage in one swoop by bringing the roof down, but this would simply aggravate the problem of head and hat clearance that already is plaguing the industry.

They could sling the frame lower between wheels, but then the driver would have to be constantly on guard around

Though car measures several inches lower, clever design has kept about the same headroom.

Body width has been increased only two inches, but lower lines give a much wider appearance.

NEW VENTILATOR, similar to Nash's, was moved from grille up onto cowl at base of windshield, where Olds engineers say it will admit less dirt, especially in city traffic.

CURVE OF REAR DOOR molds smoothly into the rear window, which like all the windows on the '54 Oldsmobile has been restyled to achieve a new "wide-eyed" look.

rutted roads, soft ground and steep driveways lest he chop up the undercarriage.

They could recess floor panels, but this again would accentuate a problem that has been getting worse: the growing transmission and drive-shaft hump.

Finally, Olds technicians knew they could use the eclectic approach, taking the best of several methods. This they did, concentrating work in seven areas:

1. Frame side rails were shaved to cut their vertical measure and widened to increase their strength.

2. The body was dropped lower on the frame by pushing the two closer together. Previous pavement-to-floor distance was 15 inches; new is 13 inches. Old underbody-to-road distance was 10½ inches; this has been chopped to 8½. Drive gear in chassis center stays up where it was.

Hydra-Matic Unit Turned

3. Over-all interior body height was cut slightly.

4. In a nice application of geometry to mechanics, the Hydra-Matic transmission unit was rotated 22 degrees to get its high hump to one side and out of the way. This necessitated redesigning both case and some shift components.

5. The next step was like straightening pigeon toes. Forward mountings for

the rear semi-elliptical springs (coils in front) were shoved outward from a higher plate between the rails to a lower one on the rails. This lowered and brought the springs from a splayed to a parallel position.

6. Four-barrel carburetor and top-mounted air cleaner were brought down an inch to squeeze them under the lower hood. The new hood, combined with the massive wrap-around windshield, makes for excellent visibility. Out of a total increase in glass area for the whole car of 278 square inches, the windshield alone claims an increase of 185 square inches.

Higher front fenders have been thrown in, too, as a visual assist in power-fingering the car into a parking space.

7. The old 11-plate battery has been replaced with a lower one of slightly different shape with nine plates. Olds made this change not only to work in a smaller case beneath the descending hood line but also to take advantage of changed ignition requirements. They were revised partly because of a new starter motor.

Foolproof Fuse Box Is Color-Coded

The other changes in Oldsmobile for '54 are largely refinements. They run the course from ironed-out, chromeless body contours to a color-coded fuse box under the dash that makes it almost impossible to mess up your electrical system.

Olds' basic overhead-valve V-8, brought out in 1950, has been made 20 horsepower hotter. They've drilled out its bore from 3¾ inches to 3⅞ and installed high-compression gaskets. The 88 engine is up from 150 horsepower to 170; the Super 88 and 98 go from 165 to a respectable 185 horsepower. Compression ratio for both engines now stands at 8.25 to 1, up .25.

As an extra nudge in this horsepower boost, breathing was improved and the exhaust system sharpened up by throwing out the old "Y" exhaust-line connection. Both right and left manifold lines now meet in a junction box. END

WHERE INCHES COUNT: The young lady is gauging the distance from the carburetor mounting to the top of the air cleaner. Careful redesign here dropped hood one inch.

FACTS ON '54 OLDSMOBILE

Model: Classic 98 4-door sedan.

Engine: OHV V-8; 185 hp. at 4,000 r.p.m.; compression ratio, 8.25:1; piston displacement, 324.3 cu. in.; piston travel (in feet per car mile), manual 1,407, Hydra-Matic, 1,331; bore and stroke, 3⅞" by 3 7/16"; torque, 300 lb.-ft. at 2,000 r.p.m.

Weight: 4,108 lb.; per hp., 22.2 lb. (with Hydra-Matic).

Transmission: standard, 3-speed synchromesh manual shift (Hydra-Matic optional); rear-axle ratio, 3.4:1 with standard transmission, 3.2:1 with Hydra-Matic.

Steering ratio: manual, 27.5:1; power, 25.7:1; radius of turning circle, 21.5'.

Effective brake-lining area: 191.7 sq. in.

Springs: front, coil; rear, 5 semi-elliptic leaves, 2½" by 58".

Outside dimensions: height, 60.5"; overall length with bumpers and guards, 214.3"; width, 78.3"; wheelbase, 126"; overhang, front 33.9", rear 49.3"; tread, front 59", rear 58".

Inside dimensions: seat-cushion width, front 62.3", rear 62.5"; leg room, front 43", rear 44"; headroom, front 35.5", rear 35.4"; seat height, front 13.2", rear 13.2"; front-seat adjustment, horizontal, 4.4".

Tire size: 7.60 by 15.

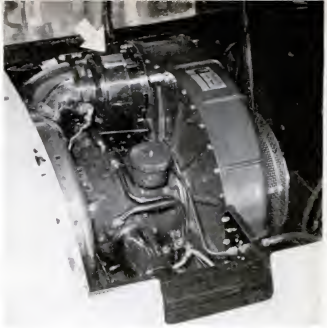
Firebird on the Desert:
America's First

Using tail fin for directional stability, Firebird roars down track at desert proving ground.

BIG SCOOPS on body feed air to engine. Smaller ones below ventilate cockpit. Car has double-wishbone torsion-bar front suspension, DeDion independently sprung rear wheels.

SPLIT-TYPE AIR BRAKES on vestigial wing yawn open to help wheel brakes stop car. Sole function of steel-lined tailpipe is to spew out huge volume of burned-kerosene gases.

Turbo Car



SEPARATE CHASSIS, snugged into regular car chassis, is used to mount engine and transmission. Arrow indicates one of two combustion chambers. At right of it is compressor; at left, power turbine. Drive turbine, behind it, is hidden by body shell. Two-speed transmission mechanically links drive turbine and rear wheels. Firebird is 222 inches long, 80 inches wide, 55 inches high at fin. Wheelbase is 100 inches. Because of high fuel consumption, engineers consider prospects of using gas turbines in passenger cars as slim.

A THING that looks like a jet airplane —right up to and including a needle nose, delta wing and whopping exhaust—has been running around on the desert near Phoenix, Ariz. But it isn't a jet. It isn't an airplane. It's America's first gas-turbine automobile.

It's driven by the same kind of continuous-combustion engine that drives Air Force jet fighters and bombers. But the power generated, instead of being used for reaction-propulsion as in an airplane, is fed to the rear wheels.

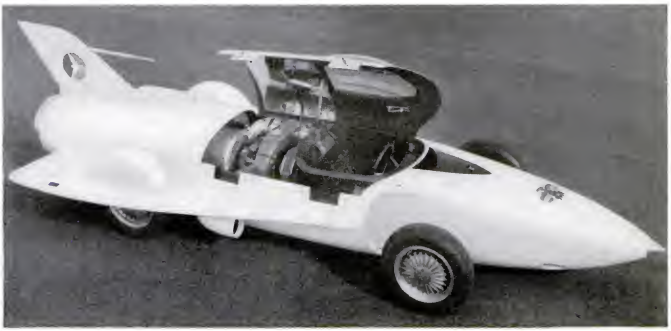
The Firebird, as the car is called by General Motors, is purely experimental. GM built it to find out whether this kind of motive power can be used in automobiles or trucks.

The Firebird is powerful. A two-wheeled turbine, mounted behind the driver, delivers upward of 370 horsepower on its diet of kerosene. The forward turbine wheel, driven by burning gases, turns at a maximum of 26,000 r.p.m.—compared with some 4,000 for passenger-car piston engines and 6,000 for racing engines—and "idles" at 8,000. The power turbine behind this wheel reaches a maximum of 13,300 r.p.m.

Driven through a gas fluid coupling, the car is always "in gear," and the high idling speed necessitates putting chocks under the front wheels to take the strain

[*Continued on page 282*]

Single canopy covers cockpit and engine compartment. Projection on belly is oil cooler.



Built to Fly:

Army Tests Aluminum Jeep

ABBREVIATED Jeep measures 8 ft. 4 in. from nose to bobbed tail, compared with 11 ft. 7 in. for standard model in background. To simplify servicing, most parts are interchangeable.

PROBLEM: to trim the fat from a Jeep, for easier lifting by plane or helicopter.

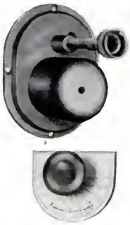
Answer: this new Aero Jeep, built by Willys for Army tests. It is three feet shorter and 1,200 pounds lighter than its not-so-big brother. It has an aluminum body, magnesium wheels and no dash instruments at all. But its 60-horsepower L-head four will wheel it at 70 miles an hour and tote a 1,025-pound payload.

Says Mike Ordorica, designer of the 1,475-pound baby:

"I started by examining each part carefully—if I could substitute something lighter for it, I did. If I could throw it away, I did. You'd be surprised how much I threw away."

New for Your Car

1. Switch Lights Your Path. With this delay switch in charge, your car's lights stay on long enough to let you enter the house, then switch off automatically. The pneumatic switch is adjustable for a delay period of up to 1½ minutes. It can be wired in to operate the headlights, tail lights, spotlight or backup light.



2. Buzzer Reminds Speeders. Designed to prevent unintentional speeding, this dash accessory sounds a warning buzzer whenever a car goes too fast. A control knob selects the threshold at which the warning will sound. The device works off the speedometer cable.

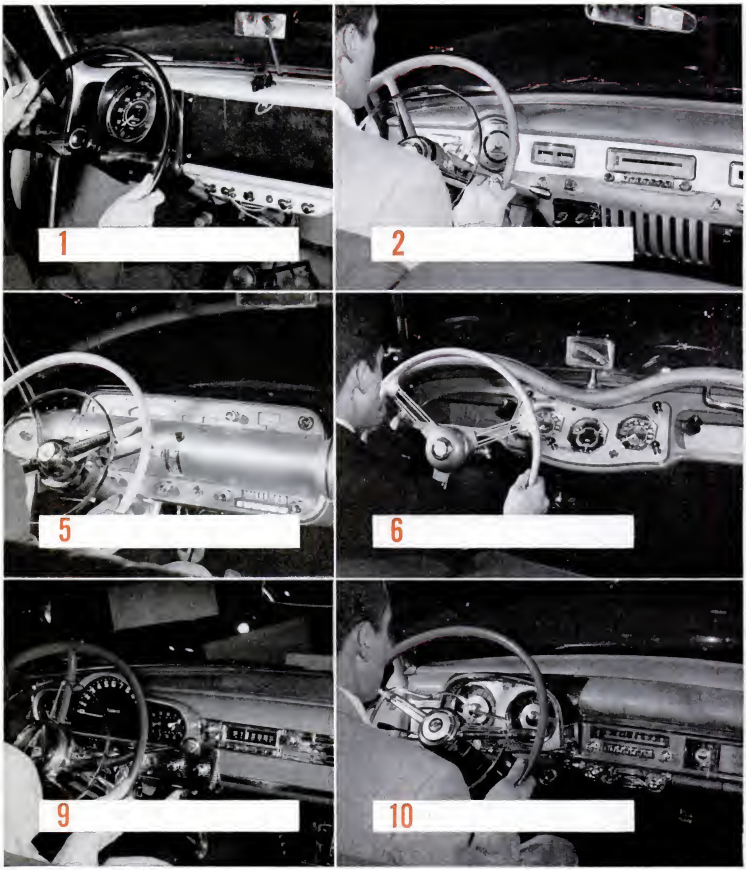
3. Pedal Is Wider. An extension that can be attached in a minute fits on the brake pedal of cars with automatic transmissions. It is intended to make left-foot braking more convenient on automatic-drive cars that do not already have a widened pedal.

4. Clicker Warns of Soft Tires. This little metal device fits between the bead of the tire and rim of the wheel. Whenever a tire loses enough air to cause a bulge to appear at the bottom—usually about eight pounds under rated pressure—it sounds off with a click at each revolution of the wheel to warn the driver.

5. Slide Rule Figures Gas Mileage. Those guesses as to how many miles a gallon you're getting will become a lot sharper with this cardboard slide rule. Each time you gas up, you set the calculator to the amount of fuel the tank takes and to the miles traveled since the last filling, and read off average gas mileage.

Further information on these products can be obtained from: 1. Edco International Corp., 9993 Broadstreet Ave., Detroit; 2. Code Industries, 625 S. Goodman St., Rochester, N.Y.; 3. Bottomley Enterprises, 14466 Ford Rd., Dearborn, Mich.; 4. Stanley Mfg. Co., 538 Ridge Bldg., Kansas City, Mo.; 5. MRMCO, 800 S. Ada St., Chicago.

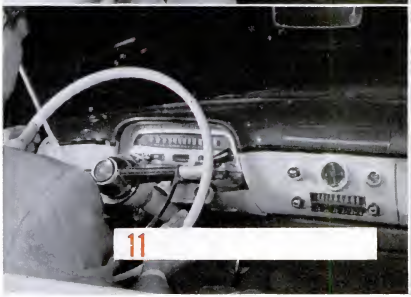
Dashboard Check-Out: What Car Are You

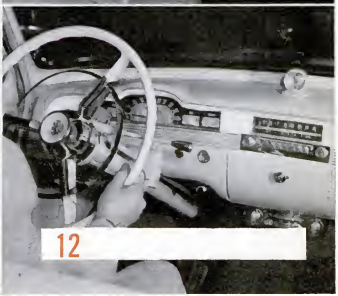


9. Hudson Hornet; 10. Chrysler; 11. Mercury; 12. Plymouth.

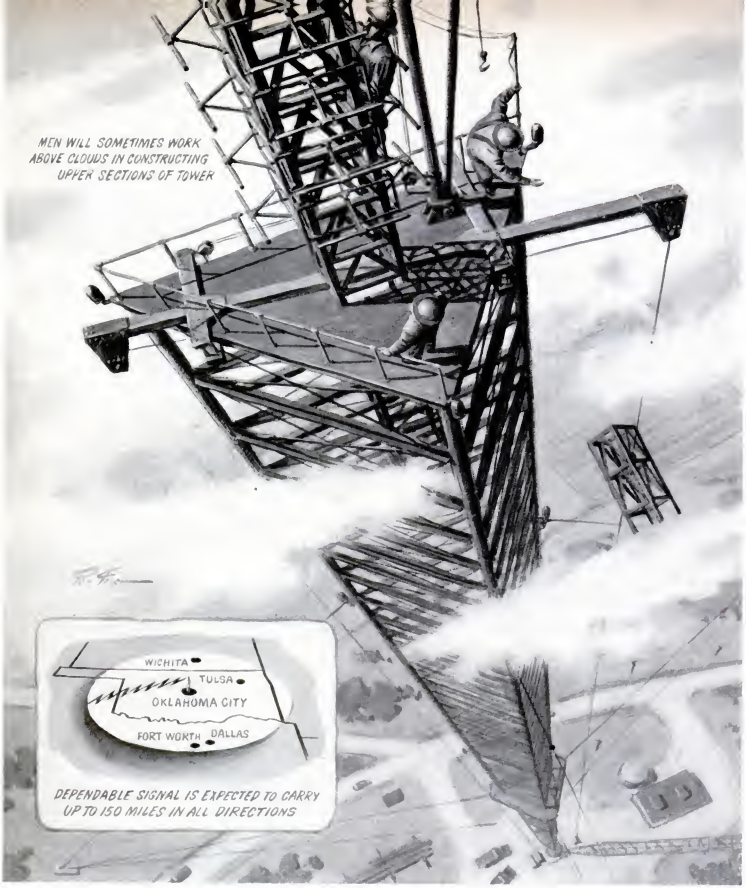
Driving?

HERE'S a chance to test your "inside" knowledge of cars. How many can you recognize, just by their dashboards? Tip: Eight are U. S. '54 models, four are British. Check below for the answers.





Answers: 1. Studebaker Commander; 2. Dodge; 3. Jaguar; 4. Austin; 5. Lincoln; 6. MG TF; 7. Studebaker Commander; 8. De Soto.

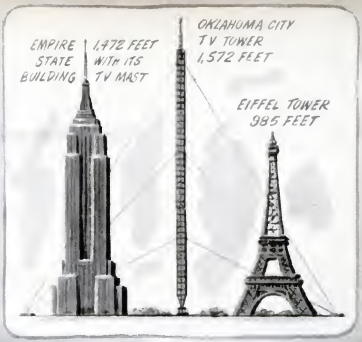


Man's Tallest Tower to Broadcast TV

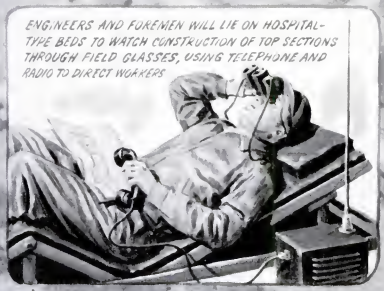
THE highest structure ever attempted by man is climbing skyward from the Oklahoma plains. A hundred feet taller than the world's tallest building, it will be used to broadcast television programs beginning next July.

KWTV, Oklahoma City, wants a lot of height to boost reception range. It's taking some doing to achieve it.

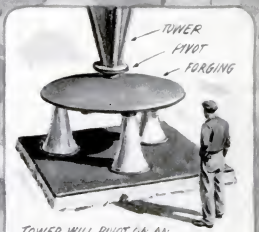
THE TOWER WILL HAVE A ONE-MAN ELEVATOR RUNNING TO THE 1,340-FOOT LEVEL



BECAUSE THE CABLES ARE NOT FLEXIBLE ENOUGH TO TURN SHARP CORNERS IT MAY BE NECESSARY TO HAUL THEM DIRECTLY ACROSS FIELDS ON A STRING OF TRUCKS WHEN GROUND IS FROZEN



ENGINEERS AND FOREMEN WILL LIE ON HOSPITAL-TYPE BEDS TO WATCH CONSTRUCTION OF TOP SECTIONS THROUGH FIELD GLASSES, USING TELEPHONE AND RADIO TO DIRECT WORKERS



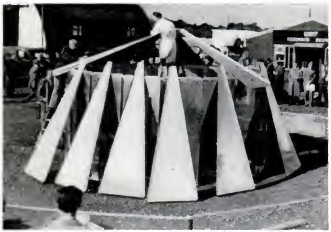
TOWER WILL PIVOT ON AN EIGHT-FOOT FORGING, PERMITTING IT TO TWIST WITH THE WIND

The tower is triangular in cross section, 12 feet on a side. The three legs are solid steel cylinders eight inches through.

Nine guy wires bracing the tower are as much as 4¾ inches in diameter—as thick as the cables on some suspension bridges—to protect it from high winds. They will be anchored in steel and concrete 900 feet from the base.

Four coaxial cables running up to the antenna are 6⅝ inches in diameter. And each ponderous 20-foot section weighs 1,600 pounds.

The tower alone will cost more than a half-million dollars. It will radiate 316,000 watts, or upward of 50,000 watts more than the next most powerful TV station in the United States. END



Arabian Potentate Buys Prefab Palace for Hunting Trips

When the new King of Saudi Arabia goes hunting, his camels will pack a portable palace. Prefabricated in England of aluminum sheeting, the three-building structure with connecting passages is lined with hardboard to insulate it on cold nights.

To keep the atmosphere of an Arab tent, 70 green linen panels embroidered with the royal arms drape the interior. A shower stall fed by a 40-gallon water tank on a nine-foot tower adds a twentieth-century touch.

Moth Balls Protect Radio Parts

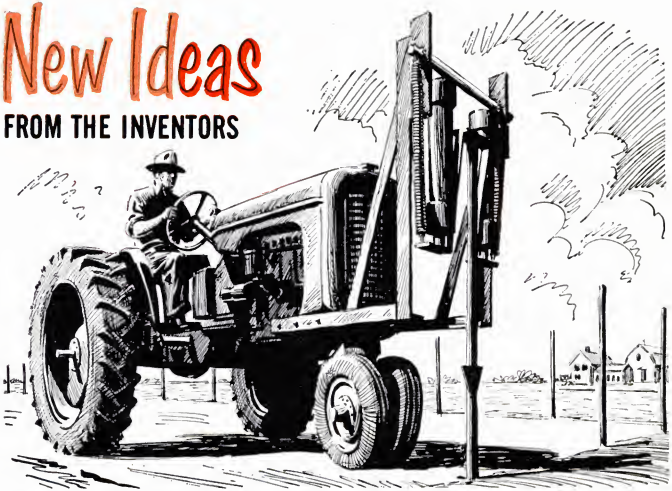
Scattering moth balls through silver-plated parts in storage boxes (above) makes assembly of radios easier for Motorola workers. The moth-ball vapor prevents tarnish, keeps parts bright and clean for soldering.

Tiny Tractor Tows Two-Ton Car

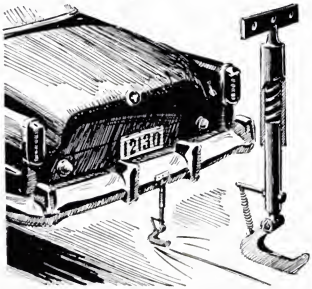
This working-model steam engine weighs less than 100 pounds but it can puff along pulling a 4,750-pound car. Complete in every detail from hinged firebox to tiniest valve, the mighty mite was built by Grant Goodfellow, garage owner of Grand Rapids.

New Ideas

FROM THE INVENTORS



1 Ram to Drive or Pull Posts. A farmer could fence his land faster if he had this tractor attachment to pull old posts and drive new ones. The bolt-on unit would take its power from the tractor's hydraulic system. The frame would support two invertible cylinders whose pistons or rams could be yoked to a fence post. The cylinders would be turned one way to lift the rams, inverted to force them down.



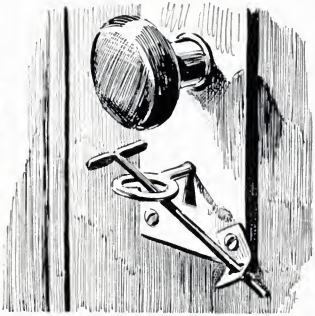
2 Car Skate to Stop Skids. A grooved drag shoe between the rear wheels might make a car track better on icy roads. This antisway device would slip in or out of a bracket bolted to the bumper. Its spring-loaded, telescoping rod would force the skate firmly against the ground but permit it to rise over bumps or high spots.

3 Straight Dial to Speed Calls. Faster phone dialing in the future may be made possible by this Bell Laboratories patent. The three-column, up-and-down drum would shorten the travel distance of the hand and reset itself much quicker. Simplified operation and easier-to-read numbers, it is claimed, would reduce dialing errors.

Please turn the page for more new ideas.

MORE New Ideas from the Inventors

4 Wheel to Warm Your Hands. This heating element could take the persistent chill off the steering wheel on sub-zero mornings. A resistance wire molded into the plastic rim would be connected to the battery through a switch and temperature-control rheostat. Slider contacts in the hub would allow free movement of the wheel.

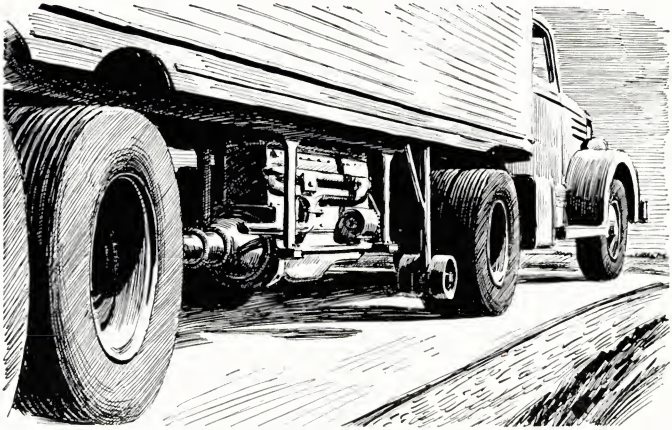


5 Pin to Make Lock Pickproof. This pin, key and spring-clip arrangement would make it hard for anyone to open the simplest back-door lock from the outside. The key couldn't be pushed out by a skeleton key inserted from the opposite side, nor could it be picked or turned while the pin remained in place.

6 Vibrator to Rock the Baby. The hand that rocks the cradle will get a little time off if its job is taken over by this spring-powered vibrator. A windup motor in the device would rotate a weighted, off-center flywheel so as to generate horizontal and vertical thrust. When hooked over the rim of a carriage, crib or cradle, the rocker would transfer the thrust in the form of a swaying motion. Its speed of vibration would be regulated by a governor. Rotation of the unbalanced wheel would be started by a counterpoised spring, stopped by a friction brake.

7 Electric Mat to Wipe Shoes. Powered brushes in this floor mat would sweep your shoes as you walked across them. Stepping on the metal grid would start a motor and oscillate the brushes through a rack-and-gear arrangement. The mat would be recessed flush with the floor. A removable tray would catch the dust.

8 Leg Sleeves to Raise Chair. You wouldn't have to prop a child on phone books if you had a set of these chair-leg extensions on hand. With them you could make an ordinary wooden chair pinch-hit for a high chair. Parents could carry them on family visits to keep thorny seating problems from arising.



9 Trailer to Have Booster Engine. A pusher engine on a trailer could supply the extra power most trucks need for uphill runs. This booster would drive the trailer wheels through a fluid transmission. Manual controls would be supplemented by a vacuum coupling from the truck-engine manifold to the booster throttle. A drop in manifold pressure (such as occurs on hard pulls) would automatically gas the pusher engine. Applying the brakes would close the throttle regardless of pressure.

U. S. patents on these inventions have been granted to: 1. F. Lindquist, Webster City, Iowa; 2. A. Leslie, Shanesville, Pa.; 3. J. Madden, NYC; 4. L. Di Langiano, Bronx, N. Y.; 5. E. Griesbach, Oak Park, Ill.; 6. G. Strom, C. Lichter and P. Rusincky, NYC; 7. R. Ryzenga, Holland, Mich.; 8. A. Worgan, Manchester, Conn.; 9. I. Simpkins, Charlotte, N. C.

How the Missing Link

Dr. Robert Broom with one of his ape-men skulls.

Theory of evolution is confirmed —and revised—by an amateur fossil hunter's recent discovery of the bones of ancient ape-men in South Africa.

By Ruth Moore

Copyright 1953 by the author

When, in the 1850s, Charles Darwin published his theory of evolution, with its startling implication that man had descended from some sort of prehistoric ape, outraged critics demanded proof: When? How? What happened to the creatures between ape and man? Where were the bones to prove that the missing links had ever lived?

Only now, 100 years later, do scientists have the answers.

Atomic research and wartime study of fluorine to prevent tooth decay have led to ways of fixing firm dates for hitherto undatable events of man's past. Recent anthropological findings show how the tremendous changes between primitive and modern man could have occurred in the relatively short time indicated by the new dates. And fossil experts have now accepted strange skulls found in South Africa, just before and after the war, as indeed those of a being less human than man but more human than the apes.

How this new evidence both confirms and revises the theory of evolution is explained in a best-selling new book, *Man, Time, and Fossils* (Alfred A. Knopf, Inc.) by a Chicago news reporter.

One of the most exciting chapters, condensed here, tells the amazing story of the man who found the missing link.

TELLTALE TEETH: Paleontologist Dr. von Koenigswald points to "simian gap" in denture of early ape-man skull. Notice that this feature is even more prominent in jaw of ape but is absent in jaw of modern man.

Was Found

FOR millions of years South Africa has been a secure platform upon which life could develop. Many of the great land masses underwent the mauling of ice and the upheavals of mountain-making. But not South Africa.

This huge tip of land has stood high and dry and little disturbed since the time when there were no forests on the earth and primitive fish swarming in the Paleozoic seas were the most

AT FOSSIL-EXCAVATION SITE in South Africa native workmen break up bone-bearing soil. In background, wearing coat, Dr. Broom is examining specimens that show bone.

advanced form of life then in existence.

Thanks to this unusually stable background, the sprawling subcontinent between the Zambezi and the Cape might well have been considered a likely place to look for fossils dating far back, perhaps even to the misty unknown beginnings of man.

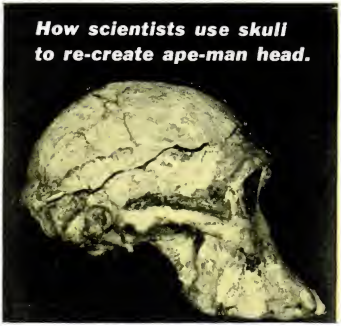
The obvious, however, is often overlooked. The world took little notice when baboon and ape skulls of types that had long since disappeared from the earth began to be found in South African caves. There was genuine surprise when a quarryman working in a lime deposit near Taungs blasted out a small skull that he recognized as unusual. It looked almost like that of a human. He sent it to Dr. Raymond A. Dart, professor of anatomy at Witwatersrand University, at Johannesburg.

As Dart cleaned it and studied it, his excitement grew. The face was almost complete. The lower jaw was there and also all the teeth, plus the whole of the right side of the brain cast. The teeth were milk teeth, with the first true molars just beginning to function. Clearly the skull was that of a young higher ape or apelike being, probably of a six-year-old. And it was a new type, Dart thought, allied to the ancestors of man.

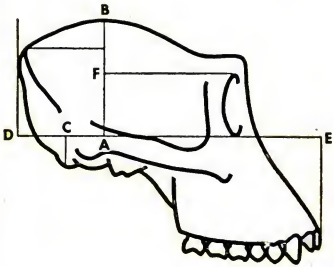
Anthropologists Were Skeptical

The doctor rushed a notice of the discovery to London. In his preliminary report, published on February 7, 1925, was the following provocative—and prophetic—statement: "The specimen is of importance because it exhibits an extinct race of apes intermediate between living anthropoids and man."

The word "intermediate" and the claim that the little skull was that of a being between apes and men—what was



STARTING POINT of reconstruction is part of skull. This almost complete specimen found by Broom is unusual. More often many fragments have to be identified and assembled.



SCIENTISTS MAKE COMPARISONS by laying out skull in precise measurement areas. Above measurements show skull height to be outside range of apes but within that of man.

popularly known as the missing link—irritated and amused anthropological circles. If Dart had announced the harnessing of perpetual motion, or the cracking of the atom, or the completion of a round trip to the moon, the skepticism could not have been profounder. His little Taungs skull, they said, was only a variety of chimpanzee.

A local visitor, a part-time fossil hunter, came to an entirely different conclusion. He was singularly well equipped to judge, for he himself had made amazing fossil discoveries in South Africa. From a one-time swampland he had dug the fossils that for the first time actually linked the reptiles and the mammals.

DR. BROOM DOFFED HIS JACKET, usually worn at all times, to examine the thrilling find when perfect, whole skull of an ape-man was uncovered in lucky blast at Sterkfontein.

Dr. Broom Gets Interested

This fossil expert was Dr. Robert Broom. Feeling sure that he had discovered the origins of the mammals, Broom often turned his thoughts to the origin of man. When he heard of Dart's discovery, it was not surprising that he hurried to Johannesburg.

There he spent several days studying the Taungs skull, and particularly the teeth. Their size and shape convinced him that the fossil child-ape was not closely related to such living anthropoids as the gorilla and the chimpanzee, but that in a number of characters it resembled man.

Dart was right, Broom decided with the quick-fire judgment that was typical of him. Furthermore, he felt certain that this was "practically the missing link," and the most important fossil find made up to that time. He wrote a paper saying so.

To Broom the fact that the large opening of the brain was situated more anteriorly than in the apes was an indication that the little ape-man child must

LOWER JAW, full dentures and other features have been added to make complete restoration of a *Plesianthropus* skull, based on specimen shown in photo at far left.

RESTORATION DRAWING of the Taungs six-year-old ape-man, first clue that a link between the anthropoids and man had been found, was made possible by this method.

have walked or run on his hind feet.

A restoration drawing of the head disclosed an engaging child. Although there always is an element of imagination in such a restoration, the drawing was based on the most precise skull measurements. The eyes, head, and ears looked human, the nose was a flat little button, and the lips protuberant.

Broom was consumed with eagerness to prove to the world that he and Dart were right. Unfortunately, he was still hampered in this desire by the necessity of making a living. His medical practice in the little town of Maquassi kept him well out of the range of the fossil caves.

Field Marshal Jan C. Smuts, the Prime Minister of the Union of South Africa, took care of this problem by offering Broom a post as curator of vertebrate paleontology and physical anthropology in the Transvaal Museum in Pretoria. Broom accepted, and at the age of 68 made his avocation his vocation.

Two of Dart's students who had read the reports came to Broom to tell him about some small baboon skulls they had found in a cave at Sterkfontein, about 30 miles from Johannesburg. Broom was at once interested and arranged to go to the place with the students on the next Sunday.

To the people of that section it was no news that there were fossils about. Since the first mining camps had sprung up during the Witwatersrand gold rush of 1886, boys had been picking up and making collections of the fossil bones of antelope, monkeys, baboons, and perhaps ape-men.

Broom and his student guides went first to a quarry where for many years a commercial company had been obtaining lime for its kilns. In breaks in the stone were many pockets of bone breccia, the composite deposit that contained the fossils.

Barlow's Find Was Rarer Than Gold

It developed that G. W. Barlow, manager in charge of the quarry and the caves, had once worked at Taungs and knew about the skull. Broom asked him if he had ever found anything like it at Sterkfontein.

The following Monday Barlow produced a find that to Broom was more valuable than all the gold taken from the Witwatersrand mines.

"Is this what you are after?" asked Barlow, presenting the doctor with two-thirds of a "beautiful fossil brain cast." (The stone bore the exact impress of the brain that once had lain there.)

It was. At first glance Broom sensed that it was the brain cast of an ape-man.

Since it had been blasted out only that morning, Broom feverishly dug into the debris. He worked until dark, but found no more than the cast of the top of the head.

The next morning early he was back. And in three hours of digging, sifting, scraping, and moving big piles of rock he discovered all of the base of the skull, both sides of the upper jaw, and some fragments of the brain case.

When all the pieces were cleaned and assembled, Broom learned that, except for the lower jaw, he had most of the skull of a creature that obviously belonged to the same near-human family as the Taungs six-year-old.

Every week during all 1936, 1937

[*Continued on page 260*]

HIGH winds drove sand and dust with such stinging force that Ed had to close all the car windows on the drive home. But there was no rain, and he covered the 20 miles in half an hour. His terrier Toby at once ran up to the car in nuzzling welcome. Lowering a window, Ed bawled an order the dog didn't obey. Then, although Ed had no thought of punishing him, the terrier ran and hid under the porch, whimpering.

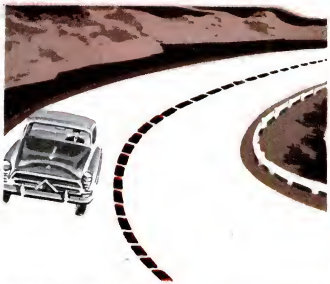
...How Come?

ANSWER: *Ed knew from experience that steady driving, wind-blown sand and dry weather had put a strong static-charge on the car. Unheeding his command to back off, Toby stood up against the car and drew a stinging spark.*

I'd Like to see them make...

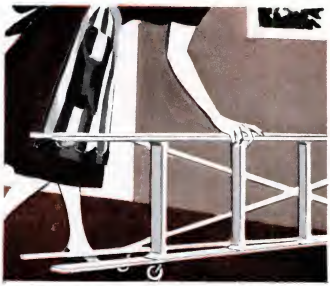
Everyone has his pet idea of a gadget he would like to see in general use. Here are five suggested by PSM readers. What is YOURS? We will pay $5 for each one published. Use postcards only. Contributions cannot be acknowledged or returned.

CLOCK RADIO with automatic station selector. Pre-setting notched controls would bring in successive stations without manual tuning.—*Mrs. W. M. Wikoff, Canton, Ohio.*



HIGHWAY CENTER LINES in color to indicate speed limit—blue for 40, yellow for 60 and so on. Curve and crossroad markings could be on road, too.—*A. Dickinson, Buena Vista, Ga.*

CHILDREN'S BOOTS and overshoes with zippers from top to toe so they could put them on and take them off without help.—*Mrs. A. T. Pohepic, Plymouth, Pa.*



STEPLADDERS with ball-bearing casters built into the sides. Moving them around would then be a simple matter for one person.—*Harry M. Segal, Atlantic City.*

A SAFETY RAZOR with a magnet built into the end of the handle so dropped blades could be picked up easily and safely.—*Verlon Denton, Grand Haven, Mich.*

Gus Aids a Hot-Rod Jockey

By Martin Bunn

THE customers of Gus Wilson's Model Garage liked to stand around and chew the fat while getting repairs or a tankful of gas. They kept Gus well informed on the case of the burned-out connecting rods in one of the Sanderson brothers' trucks.

Considering the fact that Sam and Bill

Young Howard was in a truckload of trouble and losing his

Gus ignored Sanderson's wisecrack and went calmly ahead with the job.

Sanderson did their own repair work on their several trucks, and were rather proud of their abilities as mechanics, Gus didn't think it his place to shoot off his mouth on the matter. Whenever one of the customers would drop in and inform Gus that another rod bearing had gone out on the truck that Joel Howard was driving for the Sandersons, he would puff his pipe and say, "You don't tell me!" But when Joel Howard got fired, Gus began to get curious.

"What can Bill and Sam Sanderson expect anyhow?" Silas Barnstable inquired of Gus as he helped himself to free air at the Model Garage. "Hiring a harum-scarum kid like Joel Howard!"

"I figured," Gus said cautiously, "that Joel had sort of calmed down."

"Hah!" Silas snorted. "Those kind never calm down. Been scaring folks witless ever since he was old enough to build a hot rod."

The town had its share of youngsters who were a mite heavy-footed on the throttle, but they usually came out of it when they grew old enough to get dry behind the ears. Joel Howard had fol-

bearings fast—if he lost any more his job was gone for good.

lowed the usual routine, it seemed to Gus, only he'd done it earlier than most. He'd married before he was 21, become the father of a baby the first year, made a down payment on a home, and settled down to a steady job driving one of the Sandersons' trucks. That is, it was a steady job until three connecting-rod bearings went out on the truck, one after the other. The truck wasn't a new model, but Sam Sanderson had completely rebuilt it.

"He'll have a hard time finding another job around here," Silas was saying now. "And it'll just about serve him right."

"Oh, I wouldn't say that," Gus said placidly. "The boy's young, and he's got a wife and kid to care for. I'd like to take a look at that truck."

"Eh?" Silas exclaimed. "Well, why don't you?"

Gus thoughtfully tamped tobacco in his pipe. "Don't think they'd like it—the Sanderson boys. But I wonder if anyone's put a bug in their ear about how they'd feel if rods kept flying out of that truck with other drivers? Feel peculiar, wouldn't they, after firing Joel?"

"Hah!" Silas grunted. "Never thought of that."

As the old miser drove away, Stan Hicks exploded from the grease rack.

"The old sourpuss!" he raved. "Always glad to see someone have hard luck."

Gus couldn't get the deal off his mind as he worked. When it got noised around town that Joel had been fired, no one else would hire him to drive. And driving was all the kid knew.

Sam Brings in the Truck

When Sam Sanderson drove the truck that had been causing all the trouble up to the pumps at the Model Garage that afternoon, Gus headed off Stan.

"Fill 'er up," Sanderson said. He had a grumpy look on his face.

After he'd paid for the gas and started the truck, he nodded toward the motor.

"Sounds sweet, don't she, Gus?"

"Like a kitten," Gus told him. "A pity she throws rods."

"She don't—" Sanderson snapped, "not when she's driven halfway right. But a hot-rod jockey would ruin any truck."

"How right you are," Gus said placatingly. "Still, I've known trucks that threw rods, no matter how you drove them."

"Look here, Gus," Sanderson burst out. "I overhauled this truck from stem to stern. I put in new rods and mains, and I put in the rods Joel burned out: number six twice, and number five once. And if you think the shaft is flat on those two throws, you've got another guess coming. I miked 'em."

"Rosemarie!"

"That so?" Gus asked. "Sounds like you fellows did a pretty careful job." He shook his head solemnly. "No sir, I guess there isn't much I could do then, seeing as how you fellows could hardly have missed anything, if you were as careful as all that."

Sanderson's features held a look of exasperation, and then a faint grin crinkled the corners of his mouth.

"All right, all right, Gus," he said. "I'll drive the old heap inside. If you don't find anything wrong, you buy the coffee."

"Sold," Gus grinned.

Gus didn't waste any time after the truck was in the garage. He put a tray of tools and a clean drain pan within easy reach, slid under the truck on a creeper, drained the oil. Before the oil had stopped dripping Gus had the drain plug back in and the pan dropped. He reached out for a pair of side cutters and a power bar. He snapped on a three-quarter socket, and put heft to the bar.

"Hey," Sanderson protested. "What are you doin' with that three-quarter socket? The rods take nine-sixteenths.

[*Continued on page 254*]

Steno Talks into Mask to Record Meetings

THE stenographer does the dictating with this new method for recording conferences and court proceedings. She simply repeats every word spoken, and describes actions, into the mask she holds to her face. Lightweight and soundproof, the mask contains a small microphone and is connected to a standard office dictating machine. After the meeting she can type the proceedings she recorded. The Stenomask, used by the armed services to record courts-martial, was developed by the Dictaphone Corp., 420 Lexington Ave., NYC.

Hats with Smog Masks Are the Style in London

MILLINERS in the British capital were ready for this winter's "killer fog"—it caused 4,000 deaths last year—with anti-smog hats. The decorative mask fits tightly over nose and mouth for protection, and can be flipped back when the weather clears.

Dogless Dog Sled Makes Tracks Over Trackless North

THE romantic husky of the far north may go the way of the farmer's old dobbin. With this new snow tractor in front of his sled, the northwoodsman can mush over miles of snow or ice nearly as fast and as easily as a city man drives to work. The tractor has 10 speeds forward, plus reverse, and can pull as much as a ton over rough terrain. The Highway Equipment Co., 616 D Ave. N. W., Cedar Rapids, Iowa, makes it.

Now Seamen Ride to Work

CREWMEN of 51 new oil tankers won't have to climb swaying companion ladders to go aboard or set up gangways to take on supplies. Outside elevators that hang steady even on a listing ship will lift six men or half a ton of material overside. The tankers are being built in Britain for the Shell Petroleum fleet.

▶▶▶New eight-sided mothballs with center holes slip over a coat-hanger hook. The Koppers Co., Pittsburgh, calls them Octans.

Balloon Dusts a Church

COBWEBS on the ceiling are more trouble than bats in the belfry if a church has a soaring arched roof. But at St. John's in Surrey, England, they worked out a floating duster and didn't rig a scaffold. A brush hoisted aloft by an RAF weather balloon was swept back and forth by guide lines manipulated from the floor.

▶▶▶The two highest-flying monkeys on earth—they went up 200,000 feet in a rocket—are now on display at the Washington Zoo.

Memo Pops Out of Mirror to Remind Driver of Servicing

A DRIVER can't forget to have a grease job done, change the oil or check other vital points on his car when a card is dropped into his lap to remind him that servicing is required. A new recorder built into a rear-view mirror keeps tabs on the number of hours the engine runs and pops out reminder cards as work is due. Carter Galantin, 105 West Monroe St., Chicago, developed the mirror-recorder.

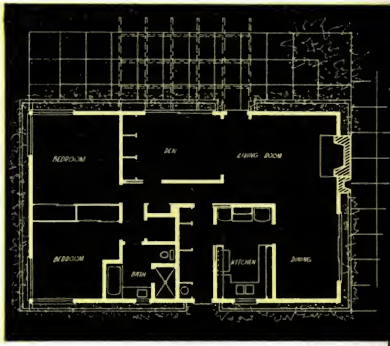
Young Californian's prize-winning design puts

A Lot of House in a Small Space

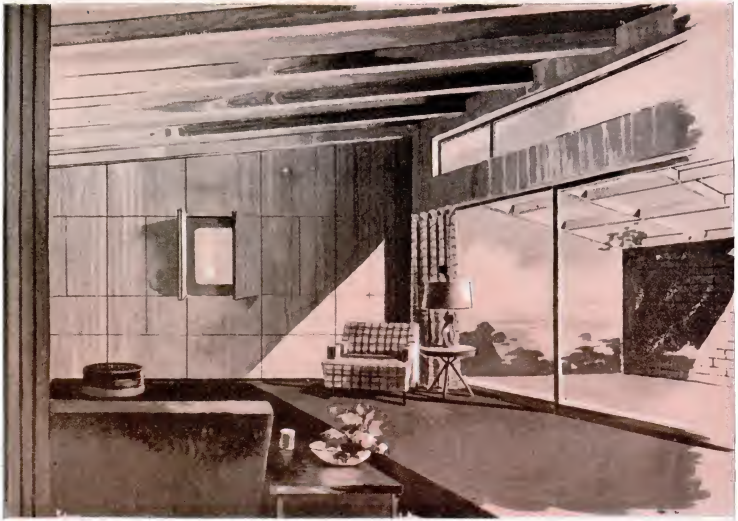
KENNETH KOOY is an amiable youngster who three years ago showed an almost elaborate lack of interest in mechanical drawing and architecture. Today, at 18, he's the champion small-home designer in California's San Fernando Valley.

Last spring the local building-contractors' association announced a contest open to high-school students only. Fifty students signed entry blanks. Ken licked his pencil and started sketching. Eight weeks later he got the word—and $300 in defense bonds.

"Your house," the awards committee told him, "shows clean contemporary design, excellent orientation to physical



EIGHTEEN-YEAR-OLD contest winner, Kenneth Kooy, compares his design (above) with the house erected by builders.



Living room and TV-area are flooded with daylight

problems, utilizes floor space to the maximum and shows a fine regard for modern building techniques."

In other words, it was a swell house. Now his little gem of architecture, covering 1,238 square feet, stands on a 55-by-115-foot lot among 21 new homes on Petit Avenue in Van Nuys. The association built Ken's dream.

Making $10,000 Go a Long Way

For the price specified—under $10,000 without the lot—what the builders' association asked for was tough:

Area, 1,150 to 1,250 square feet;

Two bedrooms and den, or three bedrooms;

At least one fireplace;

Sliding steel sash to outside;

Steel sash throughout;

At least one sliding interior door;

Steel kitchen cabinets, formica tops;

Tile walls and floor in the bath;

A stall shower;

A built-in gas range and oven;

Floors of concrete or oak;

A setback of 25 feet, a side yard, no alley, and a double garage 20 by 20 feet, attached or detached.

It had to be a one-floor house.

Ken studied the specs. He leafed through books on architecture. During class hours—mechanical drawing in Van Nuys High School—he developed a floor plan. Around it he built up elevations and a roof plan.

The result might be called a typical California house—price $8,500, plus $4,000 for the lot, plus $6,000 for many installations intended to demonstrate what the modern, labor-saving home should contain.

These include air conditioning, temperature controls, soundproofing and special kitchen equipment.

The structure is built on a three-and-a-half inch concrete slab poured over four inches of fill rock. Two 15-pound

Huge fireplace adds note of luxury

felt pads hold the moisture down. There's no basement.

Ken Kooy—all six feet, 4½ inches of him—wanted no part of drawing when he enrolled as a freshman in high school.

His educational adviser said, "You'll have to take drafting."

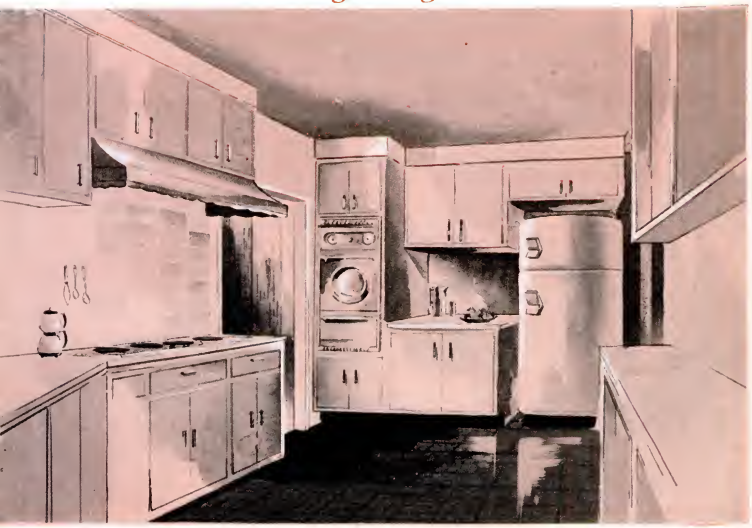
"That floored me," Ken recalls. "I simply wasn't interested."

But he did all right, receiving straight A's for the course. He discovered he liked drawing. And his instructor found an unusually professional technique flowing from the boy's pencil. Ken really got good. Presently he started drawing house plans for a local contractor.

Now in the second semester of his freshman year in junior college, Ken hopes to take a university course in architecture or building administration.

For the moment he is slightly staggered by his fame. Plans for his "high-school house" have been sought by people as far away as Virginia and Florida. —*Andrew R. Boone.*

Kitchen has built-in gas range and wall oven



POPULAR SCIENCE MONTHLY'S . . . **Last minute news & notes**

A COURSE IN SPACE TRAVEL, anticipating the day when we'll fly to the moon or the planets, is now available to students at Marietta College in Ohio...Being weightless for as long as 42 seconds has been experienced by Air Force jet pilots, who flew in a parabolic trajectory simulating that of a freely falling projectile. One pilot reported "befuddlement" on his first zero-G flight but said he overcame it in later ones.

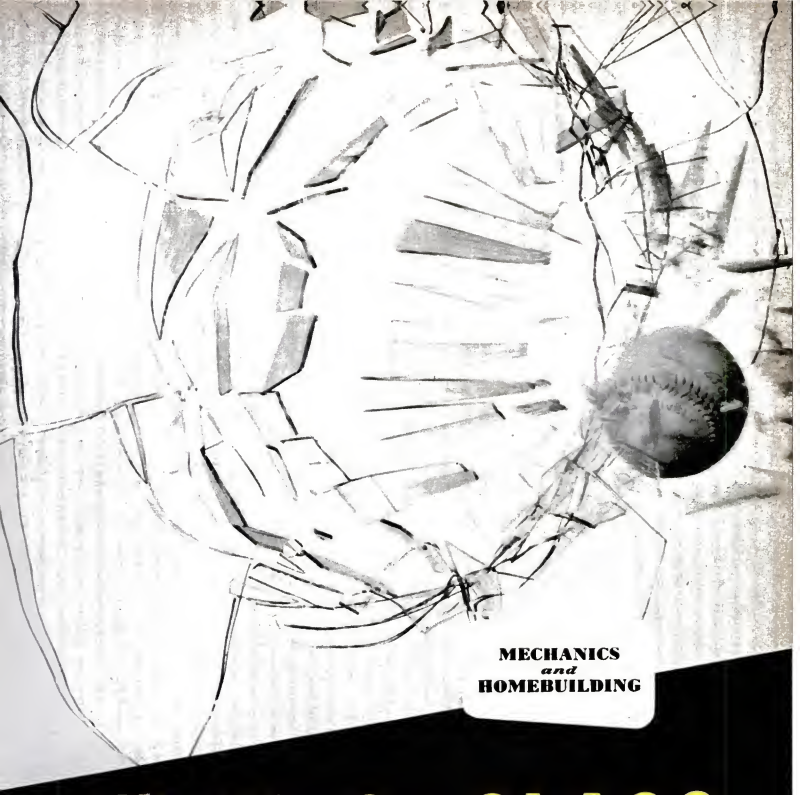
A-BOMB EFFECTS ON HEREDITY HAVE SO FAR PROVED TO BE SMALL. studies in Hiroshima and Nagasaki indicate. Parents who were injured by radiation have had a greater proportion of babies born dead or malformed, but the increase is slight...Pocket-size X-ray units have radioactive centers whose beta rays are changed into X rays by a heavy-metal case. Shutting off the wireless, self-contained unit is simply a matter of substituting a plastic sheath in place of the metal one.

THE FIRST AMERICA-TO-EUROPE TELEPHONE CABLE is now slowly reeling off into the icy North Atlantic. A joint project of the U.S., Canadian and British telephone systems, the $35,000,000 coaxial will--in 1957--add 36 New York-London phone circuits to the 12 now available by radio. No, the cable will not be able to handle television.

PROTECTION AGAINST SMOG IS BEING INCORPORATED IN TIRES made by Firestone. The new material, mixed into the rubber, keeps the tire coated with a film that stops deterioration from smoke and fumes.

YOU CAN MAKE YOUR OWN 3-D PORTRAIT by slipping a quarter into the slot of a new stereoscopic Photomat. For another dime the machine dispenses a stereo viewer...Colored salt and sugar will be marketed by Tennessee Food Products of Knoxville. Makes it easier to tell how much of the seasoning you have used...Waterproof shoes that keep out the rain and snow but still let the feet "breathe" are now being sold under the Roblee and Buster Brown brand names. The special leather treatment was developed at Battelle Memorial Institute.

BOMBERS KEEP GETTING MORE COMPLICATED	NUMBER OF ELECTRONIC SYSTEMS	NUMBER OF ELECTRONIC TUBES	WEIGHT OF ELECTRONICS
World War II Bomber	9	150	530 POUNDS
Modern Jet Bomber	14	650	2,500 POUNDS



MECHANICS *and* HOMEBUILDING

What You Can Do About GLASS

SOMETHING'S got to give when Junior's baseball collides with a living-room windowpane, as in the high-speed photo above. But you can hear the tinkle of falling fragments with reasonable calm if you're handy at working with glass and making your own repairs. Beginners and experienced craftsmen, too, will find helpful advice in the 10 pages that follow. Read them now—it's snowball time.

How to Buy It
Glazing the Easy Way
How to Cut It
Replacing a Car Window
How to Have Fun with It

Stories on the next 10 Pages

All About Glass

How to Buy It

Take these tips—to get the right glass for the job and the most for your money.

A HOME builder can get a little or a lot for his money when he buys glass for windows, doors and partitions. It's worth his while to know which glass will do what, and how to buy it. Then he won't pay double or triple prices because he's put in plate where heavy sheet glass would have done as well, or ordered glass by the sheet instead of by the case.

Window glass, often called sheet glass, is the usual thing. In most houses, it was the only kind, before window walls and picture windows came in. It comes in two thicknesses, single strength and double strength; and in two qualities, A and B.

A and B differ only in the number of small defects and waves. You'd have trouble telling most sheets in a lot of B quality from A. In fact, many dealers don't stock A quality because they don't think it's worth paying 25 percent more for. A home builder gets along without it very well.

Whether to use single or double strength depends mainly on window size. To play safe, a good rule is to use double strength for anything over about two feet square.

How large can double strength be? That's important because of a sharp price jump in the next step, to crystal sheet or plate. The answer is that, if winds don't exceed 70 m.p.h., safe sizes for double strength can reach 38″ by 48″, or 34″ by 72″. Especially for this article, a glass-company engineer worked out the calculations leading to the dimensions given.

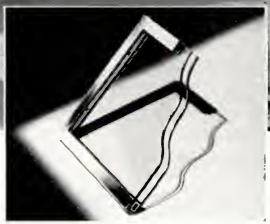
You can use these figures to work out an attractive window wall at about one-fourth the cost of the big sheets of plate glass. Go right across the room with 30″-by-72″ double-strength glass placed vertically. The distance of, say, 30″ to the floor can be plain wall or used for built-in bookcases or ventilating louvers.

ECONOMICAL WAY to buy window glass is by the case. That cuts its price almost in half, and makes it easier to handle, too. Except in very large sizes, a case contains enough sheets to make approximately 50 square feet —for example, eight 24″-by-36″ sheets.

PLATE-GLASS TOP finishes this table handsomely. To order glass for rectangular one, dimensions are enough. An irregular shape should be traced on sheet of stiff paper.

Cases save money. Buying window glass by the case is one way to save money. Glass by the case costs little more than half as much as by the sheet. And it's easier to handle.

Let's look at actual figures, based on



INSIDE, LOOKING-OUT view above dramatically compares the frost-free double-glass window at left with pair of ordinary plate units. Inset shows the sealed air space that is built into double-glazed units, providing valuable heat insulation and preventing condensation.

USE PATTERNED GLASS in home wherever light is wanted without transparency. There are many new patterns: wide and narrow corrugations, stipples, ribs and diamond designs.

HEAT-ABSORBING PLATE GLASS makes windbreak for terrace of seashore home, at Malibu Beach in California. Panes of this type, slightly tinted, filter out sun's infrared rays.

current prices for single-strength B glass (abbreviated SSB), and double-strength B glass (DSB), in one locality, northern California. (To facilitate comparison, all prices of other types of glass mentioned subsequently are for the same locality.)

By the sheet, in this region, SSB currently costs 41 cents a square foot; by the case, only about 21 cents. DSB costs 59 cents a square foot by the sheet, but only about 33 cents when bought by the case.

Thus, while four sheets of 24"-by-36" DSB would come to $14.16, a case of eight sheets costs $13.90, which is little more.

At such economical prices you can afford to use glass liberally in anything you build or remodel or enclose. And, buying glass by the case doesn't mean you're stockpiling it for years to come. Usually a case of window glass is whatever number

NOVEL USE of transparent mirror glass, which has no opaque backing, is to cover a recessed light in a bathroom. With the light off, you have a mirror. When the light is turned on, as above, it shines right through. (What makes the reflection seen in the photo is simply the light used in taking the picture.)

of sheets comes nearest to totaling 50 square feet. Cases of very large sheets contain 100 square feet.

In furnishing these facts and figures, an experienced builder comments, "For my money, DSB by the case is a best buy. I use it for practically everything."

Crystal sheet, heavy window glass of good quality, is the economical thing when the opening is too big for double strength. It costs 60 to 70 cents a square foot.

Plate glass, polished nearly to optical perfection, may be ⅛″ thick or, for a big view window, ¼″ thick. It costs $1.25 a square foot, and a bit more in sizes over 50 square feet.

Do you need it, or not? If the view from the window is a short reach of your back yard, use crystal sheet—you'll never notice the slight waviness. If your view is of the ocean, or the next county, it calls for plate.

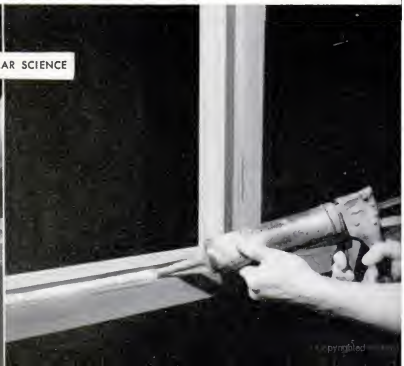
For plate and usually crystal too, in sizes bigger than you can handle and too expensive to risk breaking, you must figure on paying a higher and variable installed

Glazing the Easy Way

To build windows and window walls, "fancy" professional method is simplest and best.

1 TO FORM RABBETS, rip ¾″ strips from one-by-fours, saving the strips. Nail on the narrowed one-by-fours, with their inside edges flush with the edges of the two-by-fours.

2 SEAL WOOD with prime coat of paint or natural finish; then run a bead of gun-grade glazing compound. (Putty knife and compound or soft putty are okay but slower.)



price, which includes expensive labor cost.

Heat-absorbing plate glass, while no substitute for air conditioning, does screen out quite a lot (29 percent) of the sun's heat. It's used in west windows of seaside homes, as well as in car windows. Cost is about 2½ times that of ordinary plate.

Obscure glass is fine for a window with a view you're better off without. It makes partitions, too, where light is wanted but visibility is not. A wall of it may be just the thing for a basement recreation room, if part of the basement is used as a garage. For this you'd want the thick variety, say ⅜". Thinner figured glass serves for entrance panels, cupboard doors and shower enclosures. Prices range from perhaps 60 cents a square foot for ordinary obscure glass to $3 or more for the heavy structural types.

Transparent mirror glass, used for one-way vision in entrance doors, has other interesting possibilities (see photo). Ready-made it costs about $6 a square foot, but a glass dealer who makes mirrors can usually prepare it for you at about half that price.

All About Glass

Insulating glass is the modern, vastly superior replacement for an ordinary window plus storm sash. By preventing escape of heat from a house, it makes it comfortable to sit near a big window on a cold evening. Like any insulation, it usually pays for itself over the years in fuel savings as well as comfort.

It consists of two or three panes sealed in units, with air spaces between the panes. A typical double-glazed unit has two sheets of quarter-inch plate glass with a half-inch air space between. This type costs around $3.25 a square foot.

Originally all insulating units were of plate glass, but now you can buy this kind of glazing in window glass, too. Unless you need large panes, you can save about one-third by using the window-glass kind.

When it comes to building a window or a window wall (far left), the fancy way is the amateur's best bet. It gives a really superior job, works with panes of any size and takes hardly any skill at all.

Usually glass is set into a frame, held with glazier's points, then sealed with putty. This takes practice and if it isn't done just right, it may not last.

The method advocated calls for backputtying and setting wood stops. Professionals use it for big windows or de luxe installations; when they do, it costs more. But it's the ideal do-it-yourself way, simple, foolproof and much better looking.

Use dry lumber of good quality (in photos, redwood), as some will show. Begin a window wall by building a frame of two-by-fours, with openings ¼" bigger each way than glass size, and proceed as below.

3 PUT GLASS INTO PLACE, pressing gently all around until glazing compound fills space between glass and wood. If putty is used, worked-in paint thinner will avoid stiffness.

4 NAIL IN THE STOPS, the leftover strips, after priming them. If window catches much rain, make sure pushed-up putty forms seal between glass and stop. Add more if needed.

All About Glass

How to Cut It

Even a beginner can use a glass cutter like an expert by applying these rules.

THESE things are all you need to cut glass like an expert: a good glass cutter in first-class condition, care in following the rules and plenty of scrap glass to practice on. Most of the secret of glass cutting is the experienced, confident touch that comes quickly with practice.

In using the cutter the whole idea is to scratch a uniform, unbroken line along the surface. Then the glass parts easily in your hands when bent at the scratch. (Science says tension is what breaks glass and *the crack always runs at right angles to the tension*. So, apply tension exactly crosswise to a scratch for clean breaks.)

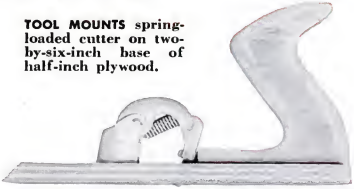
To part glass ¼″ or more thick, lay it on cloth or papers, scratched side down; lightly tap a cold chisel resting over the scratch, and aligned with it, using a *small* hammer. Repeat at other places if necessary.

1 TAKING PAINS pays off. Clean the glass, if it's not brand-new. Use well-kept or new glass cutter; the best is inexpensive, and an inferior, cheaper one is a false economy.

4 DRAW CUTTER across glass with firm but not heavy pressure. Start ⅛″ from one edge and run right off other edge. Yardstick, wetted so as not to slip, serves as a guide.

"Plane" Applies Cutter With Just-Right Touch

HELD down on a pane and pushed, this tool automatically cuts glass with correct, even pressure. To make it, remove roller from a screen-door closer and squeeze metal nearly together in vise. Insert sawed-off glass cutter, drill holes and rivet with nails. Mount on plywood, holed to let cutter wheel protrude about ⅛″ beneath, and add handle. Draw line to front to show where cutter is.



TOOL MOUNTS spring-loaded cutter on two-by-six-inch base of half-inch plywood.

2 LUBRICATE WHEEL of cutter with any household oil before use. This serves a double purpose, helping wheel turn freely, and aiding cutting action by spreading oil upon glass.

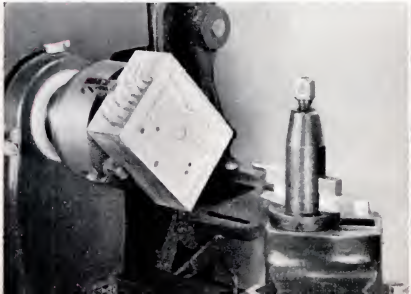
3 HERE'S RIGHT WAY to hold cutter—between first two fingers, thumb beneath. When drawn along glass it should be raised nearly vertically, as shown in the next picture.

5 WHERE SCRATCH ENDS, gently bend glass downward on each side, and it will part. If strip is too narrow to grasp, break it off with flat-jaw pliers or slot of glass cutter.

6 TO CUT CIRCLES, special cutter resembling compass is used. Then regular cutter makes radial lines from circle to edges. One at a time, outer sections are removed.

Here's a Way You Can Cut Small Glass Disks on Your Lathe

When you need a glass disk for a meter or flashlight, try cutting it on your lathe. True up the face of a wooden block with a freshly sharpened round-nose bit, undercutting the center. Attach the glass blank to the block with rubber cement (left below). Score a circle of desired size in the glass with a carbide-tipped bit. Remove the blank and trim by breaking off excess glass with pliers (right below).



All About Glass

How to Repair Auto Glass

Replacing a broken car window yourself will save you dough—and here's the way to do it.

It's a howling winter night, as luck would have it, when your key chain breaks and you lose your car keys in a snowdrift. You break a ventilator window to get in, short the ignition to get home—and next day you learn the cost of replacing safety-glass car windows. It comes high.

But many wrecking lots sell safety glass for a few cents, or give it away. Knowing the trick of working with it, and replacing broken or cloudy car windows yourself, will save sizable bills. Pictures on these pages reveal the secrets, learned from a junkie who was doing a brisk business in making new windows from old.

Safety glass consists of two pieces of high-quality glass with a plastic layer between—so you can't cut through from one side. When you try cutting both sides, there's still the baffling problem of getting at the tough plastic. For straight cuts the answer is to bend the fracture over the edge of a board, opening the cut enough to cut the plastic with a razor blade. On curves, a coil of resistance wire laid over the cut and plugged into the house current for a few seconds softens the plastic with heat. Then the glass practically falls apart by itself.

You can use salvaged safety glass around the house, too. Medicine-cabinet shelves made of it won't scatter razor-sharp fragments if the kids break them. Elsewhere it can serve instead of costly plate glass.

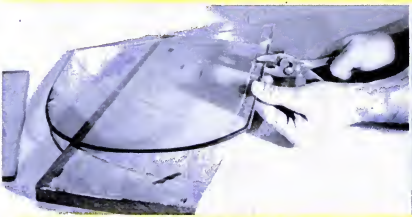
1 REMOVING BROKEN VENT from its frame is easy after you have removed the assembly from car. Spring the frame open enough to loosen edges and ease out the cracked pane very gently, so it can be used as a pattern.

4 STRAIGHT PART of cut is flexed over board to open fracture, and razor blade drawn through it cuts the plastic. The scrap glass used here has bubbles around edge, but usable portion is enough to make new pane.

7 AFTER COIL IS PLUGGED IN, heat softens plastic in five to 10 seconds. Pull plug quickly, and pick up glass as above. Pieces should now pull apart, or separate enough to insert razor blade. If not, apply heat again.

2 TRANSFER OUTLINE to paper. If window is too badly damaged to serve as pattern, use a piece of cardboard, after shaping it by cut-and-try method. This must be done accurately if replacement pane is to fit.

3 LAY NEW PANE over pencil outline and cut each side of laminated glass, by following outline with standard glass cutter. Note that straight cuts continue past curve to edge, to assure breaking in right places.



5 PLIERS NIBBLE along strip too narrow to respond to hand pressure, in order to fracture glass and open cut, so razor blade can be inserted. Alternate procedure could use hot wire along score mark as in next view.

6 AT CURVES, nichrome wire coil (from junked heating appliance, or available as replacement element) is laid along scored and fractured cut, and connected in series with extension cord. Bolts hold it in place.

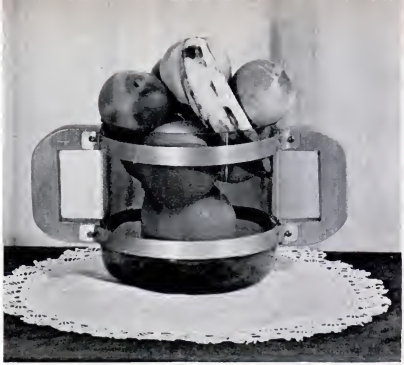
8 ABRASIVE PAPER smooths sharp edges. Use coarse grade for fast job on unexposed edges only, as it may chip them. Smooth ones need polishing with medium, then fine grade. Used paper from a floor sander works fine.

9 TO HOLD GLASS in frame, you can buy fabric-base strip at car-body shops, but rubber electrician's tape will do. Trimming edges neatly is last step. In this case, glass cost nothing; total expense was for tape.

All About Glass

How to Have Fun with It

Assemble this simple electric bottle cutter and enjoy the hobby of glass craftwork.



HANDSOME FRUIT BOWL was cut from a large bottle. Brass strips attach wooden handles. Possibilities of bottle craftwork, limited only by hobbyist's imagination, include glasses and steins, flower vases, pretzel dishes and smoker's articles. Bottles yield many utility items such as paint and brush containers and wide-mouth glass funnels.

ONCE you discover how easily you can cut bottles in two, and turn them into bowls, ash trays and other craftwork, no bottle in the house will be safe from you.

A sure-fire electric bottle cutter has now been devised, simple both to assemble and to use. It even eliminates scratching a line with file or glass cutter around a bottle to be cut—a necessary preliminary in methods used before.

Looped around the bottle, an electrically heated strand of nichrome wire does the cutting. A support for the wire, and means to keep the flow of current under control, complete the device.

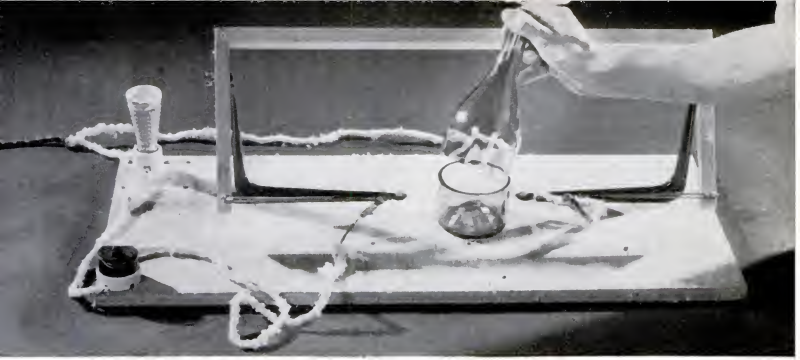
For the nichrome wire, obtain a 600- or 660-watt replacement heating element for household appliances, which costs a quarter or less. A 660-watt cone heater unit (about 60 cents) makes a current-controlling resistance unit; and a porcelain socket for it, a pair of clip-on terminals, and some heater-type electric cord with a plug are the remaining electrical items to rummage for or buy.

Straighten the coiled-up nichrome wire by stretching it and then, grasping one end with pliers, by drawing it through vise jaws or between blocks of wood in a vise. As needed, lengths may be cut off to suit the size of bottles to be cut, which may range from tiny vials to one-gallon jugs. Connect up the cone heater unit, switch and clip-on terminals in series, or so that current will flow through each in turn. (See diagram.)

A light wooden frame, pivoted to brackets with small bolts and wing nuts, supports the wire and adjusts it conveniently to any desired height. To draw the wire loop taut around a bottle, the ends of the wire (which don't get hot) may be hooked to the frame with inelegant but effective rubber bands.

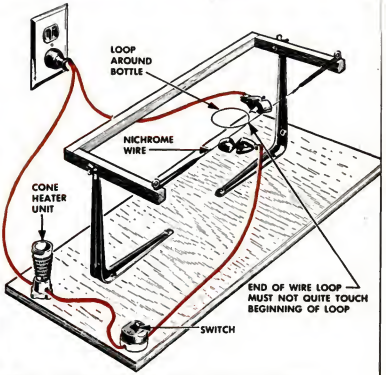
For use, detach one end of the wire, loop it around the bottle and refasten it. Adjust the loop even and level—except that its beginning and end must *not quite touch.* (If they do, current will bypass the loop and it will fail to heat.) Clip the terminals to the wire near the bottle, one on each side of it. Then snap the switch to "on." The wire, or its free part at least, should glow red-hot.

Soon the bottle may snap of its own accord. If it doesn't, say within a minute, apply one or more drops of cold water from a medicine dropper—right at the hot wire—and it will. Then *turn the switch right off* to prevent accident from a forgotten hot and live wire. Finally, smooth the edge of the cut piece with Carborundum powder, moistened with water, in the way illustrated.



ELECTRIC BOTTLE CUTTER severs glass with hot wire, as above, yielding pieces to be turned into decorative and useful objects. Anyone can quickly assemble device at small cost. U-shaped wooden frame, pivoted in brackets, supports cutting wire at adjustable height. Looped around bottle, wire is drawn taut by rubber bands attaching cool ends to frame.

FIRST THING TO DO after cutting bottle is to smooth sharp edge, and even out any irregularities, by rubbing piece with circular motion against Carborundum powder and water smeared on glass. The more even the cutting, the less grinding will be needed; usually about three minutes' work with coarse (No. 30) powder should do the job. If smoother-finished edge is desired, finer-grained abrasive can then be applied.



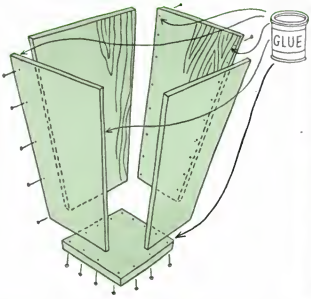
SKETCH SHOWS DESIGN and electric connections of bottle cutter. Connected in series are cone heater unit, on-off switch and looped piece of nichrome wire, which should glow red-hot when switch is on. (If necessary, to get wire hot enough, current could be beefed up a little by placing cone heater unit in double socket with 100- or 200-watt lamp bulb, or—for experts only!—by just bypassing one or two turns of cone's coil.)

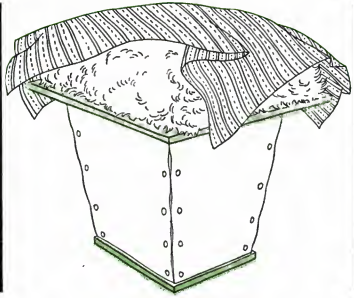
SMOKER'S SET was cut from bottles. Brass bands for decorative touch are optional.

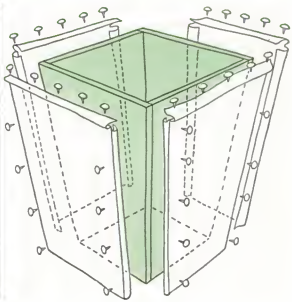
Articles from bottles of colored glass often need no adornment to enhance beauty. END

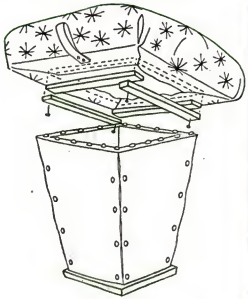
By Roy Doty and E. L. Britt

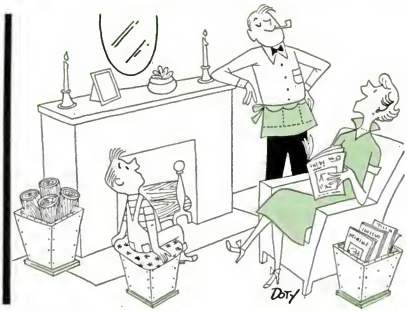
Wordless Workshop









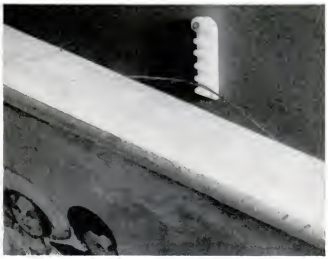


Next Month: A table built from ready-made parts.

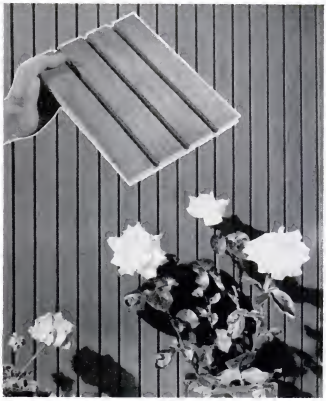
New for the Handy Man

1. Tiles Need No Cement. You can put down these rubber floor tiles as fast as you can fit them together like pieces of a puzzle. The interlocking tiles need no cement, are not affected by moisture and can be laid over wood or concrete above or below grade. They come in ¼″ and ½″ thicknesses and in a variety of colors.

2. Hanger Adjusts to Five Levels. This plastic hanger makes it easy to line up your pictures like soldiers on parade. The ridges give you five positions, eliminating need for removing nail from wall.



3. New Cube Tap. Extension cords of any length can be quickly made up with these receptacles. The wire is slipped in and the cover closed, forcing two metal prongs through the insulation to contact the wire.



4. Grooves Style New Plywood Panel. This new exterior paneling has deep parallel grooves ¼″ deep and ⅜″ wide running lengthwise on its face. The grooves are 2″ apart on 16″ panels and 4″ on those 32″ wide. Both sizes come in 8′ and 10′ standard lengths. The panels are made of ⅝″ fir plywood with the surface left unsanded and with small knots to give a natural, rustic appearance. Because of the grooves, the shiplapped panels need no special joint treatment.

Further information on these products can be obtained from: 1. R. L. Mitchell Rubber Co., 2114 San Fernando Rd., Los Angeles 65; 2. Jiffy Enterprises, Inc., 1011 Chestnut St., Phila. 7; 3. Academy Electrical Products Corp., 3842 Ninth Ave., NYC 34; 4. Douglas Fir Plywood Assn., Tacoma 2, Wash.

SEESAW is quickly made with 1″ pipe and new slip connectors. Pipe lengths required: one 8′ for teeter beam, four 28″ for legs, one 24″ for crossbar, four 10″ for handles.

Now Anyone Can Build with Pipe

New threadless couplings let you make toys, tables, railings—anything of pipe—as fast as you can slip the parts together.

By Sheldon M. Gallager

YOU can set up the child's seesaw shown above in just five minutes, once the pipe has been cut to the right lengths. A frame for a swing would take longer—maybe an extra 10 minutes. Or perhaps you'd like adjustable storage shelves or a knockdown scaffold that can be put together in a few minutes, then quickly taken apart for easy storing or carrying in a car.

All these, and many more, are made with new lightweight, aluminum connectors that join pipe without threads. You simply slip in the pipe, tighten a setscrew and it's locked in to stay. Because there's no threading, welding or bending required, you can cut the pipe yourself, put it together and take it apart whenever you want, and keep using the same fittings over and over.

Six basic types of connectors, including tees, corners and adjustable swivels, can be combined to form anything you can build with pipe. They come in five different sizes to fit standard pipe from ¾″ to 2″ in diameter, and are also available in various combinations so two different sizes of pipe can be used together.

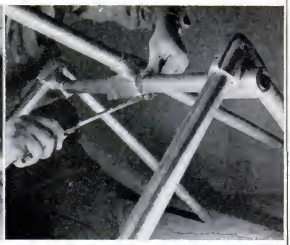
Fittings save work. Because the connectors have a special offset design, permitting pipes to cross each other, you don't have to make as many cuts. One long length can pass right through half a dozen connectors, saving the work of cutting and fitting at each joint. This also provides greater strength, making possible projects like the seesaw, where the teeter beam must remain unbroken at the middle for sufficient support.

Because one pipe can slide past another

How Seesaw Is Assembled in Six Simple Steps

PIPE CAN BE CUT with hacksaw using coarse-tooth blade. Tape wrapped around pipe guides saw to insure straight cut. Local plumbers will also cut pipe to order for small charge.

PIPE IS SLIPPED into fitting and locked tight with Allen wrench that turns setscrew. Fitting shown is 90° corner connector used to join legs to crossbar at each side of seesaw frame.



TEETER BEAM pivots on cross fitting slipped loosely over horizontal bar. Hose clamps tightened on either side of beam make inexpensive bearings to keep beam centered.

END CAPS dress up exposed pipe ends, conceal rough edges. Caps have soft metal flange that cuts its way in, making tight fit. Use heavy hammer, block pipe on wood.

SEATS ARE MOUNTED on teeter beam with wall flanges screwed to underside. Use 2″ pine stock, shaped as shown, and locate flange so pipe, not seat, will strike ground.

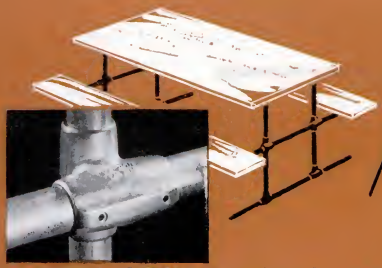
HANDLE BAR is made with straight tee that fits on teeter beam and offset tee that holds crossarm at top. Be sure to cap rough pipe ends that might hurt hands or clothes.

one, you can also make structures not possible with ordinary fixed-pipe fittings. Shelves, scaffolds and loading hoists, supported on the slip connectors, can be quickly slid up or down on vertical pipe for easy adjustment to any height. Swivel joints can be made by simply slipping a fitting loosely over a pipe instead of locking it tight. And if baby sister wants to balance big brother on the seesaw, just slide the teeter beam off-center and retighten it.

The fittings, called Nu-Rail, have a structural strength equal to that of the pipe itself. They are made by the Hollaender Mfg. Co., 3841 Spring Grove Ave., Cincinnati 23, Ohio.

WORKBENCH, made here for use by several shop students at a time, can easily be adapted for home bench. Sturdy frame for table top is made with only four legs and two diagonal cross braces. Swing-out seats are circles of plywood mounted on short pipe arms that pivot on legs.

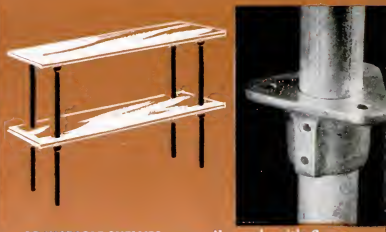
Six Basic Fittings Will Build Any of These



PICNIC TABLE has built-in seats, requires only four pipes at each end, held by cross fittings where they intersect. Table top rests on floor flanges, seats on wall flanges.

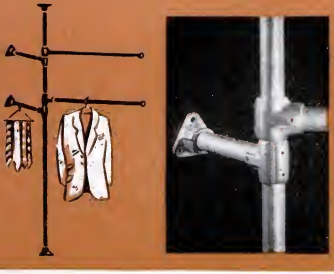
SWING FRAME uses two straight-tee fittings for legs combined with adjustable swivel that holds diagonal end brace. Two halves of swivel are locked together on short pipe.

RAILING CORNERS are made with 90° elbows slipped over posts. Same fittings are used at top, capped off with end plugs. Slanting railings are made with adjustable cross fittings.

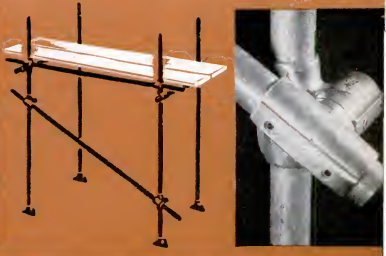


ADJUSTABLE SHELVES are easily made with floor flanges turned upside down and screwed to underside of planks. Shelves are drilled to slip over pipe, can be quickly set to any height.

SWING-OUT CLOSET POLES make clothes easy to get at, are simply short arms mounted loosely on vertical pipe. Arms pivot on braces screwed to back of closet to serve as supports.



PORTABLE SCAFFOLDS can be made any size, are quickly put up or taken down. Adjustable cross fitting can be set to any angle, permits use of strong diagonal brace. END



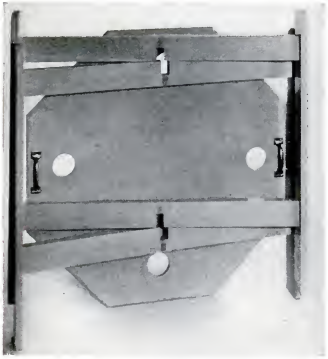
Tray Table Totes Meals for Four

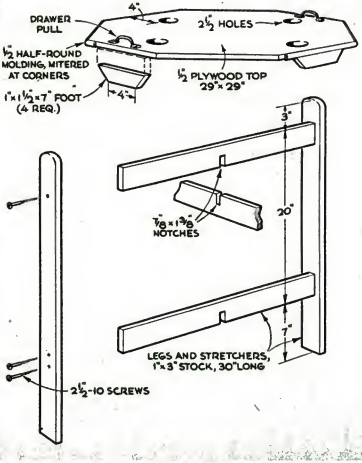
It gives lots of leg room for dining and folds flat for storage.

EVEN filled glasses can be put on this tray table right in the kitchen, so a whole luncheon can be carried in to your guests at once. Besides seating four for dining or games, it's ideal for buffet serving.

Lay out the top on ½" plywood by marking off 45° corners along the sides of a square. Check by measuring the eight sides, which should be of equal length. Cut holes to fit your glasses with an expansive bit or circle cutter. Miter half-round molding around the edge. Glue and screw or brad on four feet. Cut frame members from one-by-three stock. Enamel or laequer makes a good finish.—*Jim Anderson, Berkeley, Calif.*

TRAY TOP measures 30" across, has handles on top so that it can be carried through a 32" doorway. Base consists of two assemblies that pull apart as below for flat storage.





CUT NOTCHES in top edge of one pair of the stretchers, in lower edge of other to form half-lap slip joints. Make notches a close slip fit so table will stand firmly. Corners may be chamfered for easy assembly.

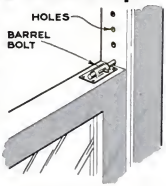
The Shelves Slide Out in This Shutter-Door Linen Cabinet

CHARM plus utility were what my wife was after in a bathroom linen cabinet. I gave them to her in a neat job featuring doors made from old shutters, shelves that slide out for easy reaching, and an interior covered with decorative wallpaper.

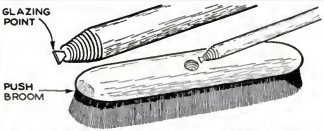
The cabinet is 30½" high and 33" wide. The top, sides, bottom, center partition and shelves are 1"-by-12" white pine used full width. A sheet of ¼" plywood is rabbeted into the back and fastened with glue and finishing nails. Rabbets were cut in the ends of the shelves, leaving projections to slide in ¼"-by-¼" dadoes in the uprights.

The doors, made from the upper half of a pair of window shutters, are mounted with butt hinges. The interior was painted with sealer and papered.—*John Rogers, Dallas.*

Barrel Bolt Locks Window Open



You can leave a window open an inch or two and still lock it securely if you mount a barrel bolt on top of the lower sash. Then drill a vertical line of holes in the casing of the window to accept the bolt at several different levels. The top sash can be locked in the same way by placing a bolt on the side of its frame.—*Lewis Booker, Louisville, Ky.*



Glazing Point Tightens Handle

DRIVE a glazing point part way into the end of a loose-fitting push-broom handle to keep it from twisting out as you use it. As the handle is threaded into the broom, the point will strike the bottom of the hole. Continued pressure will cause it to bend out and dig into the wood, preventing any future loosening.

Anton Bohaboy turns out powerful little steam engines and boilers on a one-man assembly line. That's why he's the

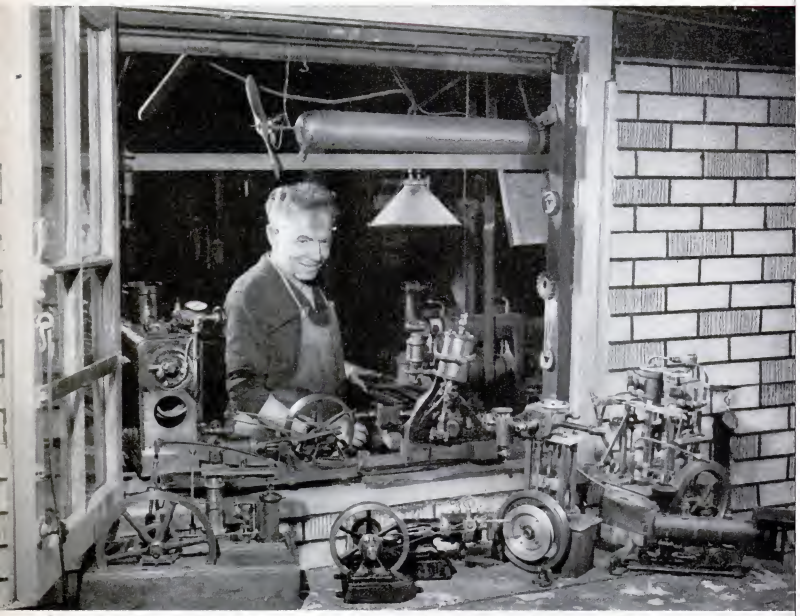
Tea-Kettle Henry Ford

By Harry Walton

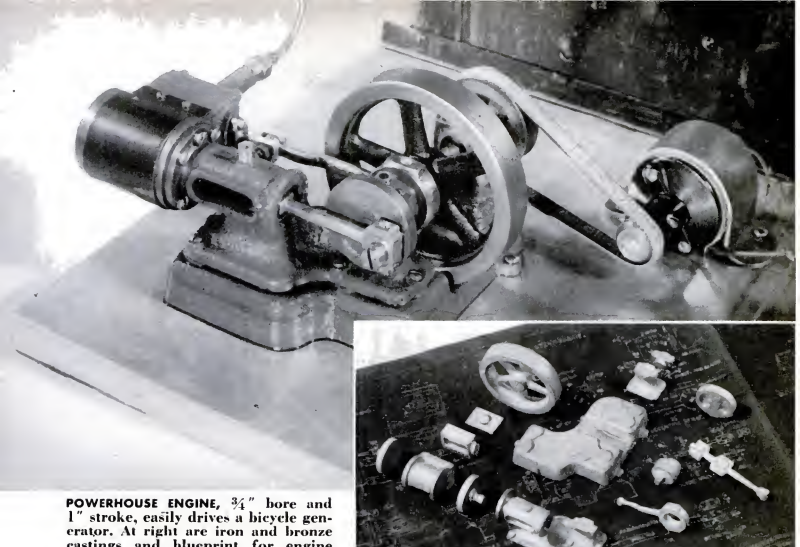
"STEAMBOAT burns in Central Park," screamed a newspaper headline some years ago. The skipper of that craft was a shockheaded young Czech named Anton Bohaboy, the ship a steam-powered model in which the fire had gone out of control.

But a reporter's gag didn't end Bohaboy's enthusiasm for steam power, which has stayed at high pressure for more than 30 years. Today, in a tiny garage workshop as cluttered as Fibber McGee's closet, this wiry, bushy-haired master machinist still keeps the Age of Steam alive.

From that shop at 2297 Price St., in



GLIMPSE INTO WORKSHOP shows Bohaboy with some of the engines he has made. At left inside window is big boiler, at right a large oscillating-cylinder engine, overhead a compressed-air tank with rotary aircraft motor (cylinders turn with prop). In foreground (left to right) are a beam engine, horizontal engine with working governor, vertical single-cylinder engine, vertical twin with reverse gear, and a No. 1 gauge steam locomotive.



POWERHOUSE ENGINE, ¾" bore and 1" stroke, easily drives a bicycle generator. At right are iron and bronze castings and blueprint for engine sold by Bohaboy. Kit includes all steel and screws needed. Price is $9.

Rahway, N. J., Bohaboy has shipped engines and boilers to Burma, Sweden, Peru and Australia. They have driven boats, bicycles, model planes and machinery. Among his customers have been doctors and taxi drivers, GIs and millionaires.

But Bohaboy is best understood by his workshop, which occupies a one-car garage much too small for a modern sedan. Machinery crams it to the rafters. Two lathes, two drill presses and a milling machine are run from overhead line shafts. In one corner hulks a gigantic old-fashioned shaper.

Everywhere are stacked boxes of parts, bits of dismantled engines, and models under construction. His workbench boasts an inch-thick steel plate about a foot square as its chief working area.

Shafting ends, blocks of steel and chunks of scrap iron lie piled on the floor around every machine. "As ballast to keep them from floating away," his wife wryly observes.

As bustling and energetic as one of his engines under full steam, Bohaboy turns out work at a phenomenal rate. Homemade jigs speed machining of his stock engines. He keeps a steel rule at every machine, a micrometer at each lathe. Every tap is permanently mounted in its own tap wrench, each die in its own holder.

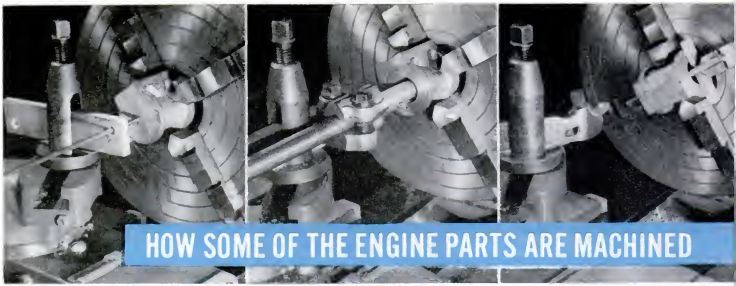
Bohaboy Does a Job in Jig Time

Under his quick hands a chunk of cast iron becomes a cylinder, a bit of bronze a valve, a rough disk an eccentric. He consults no blueprints, rarely makes drawings, even of a new engine, in advance.

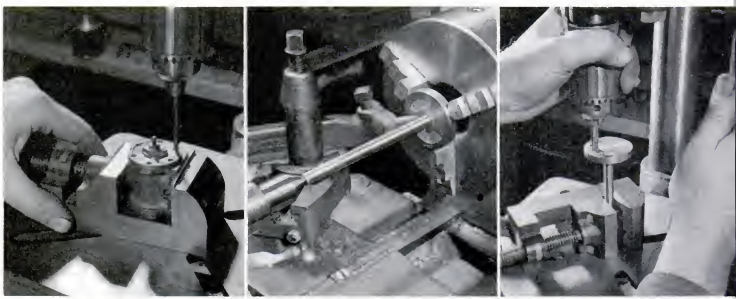
When the engine above was being hooked up, an extra-long steam-chest fitting was needed. I timed Bohaboy as he made it.

Chucking a piece of hex brass, he turned one end, by eye, close to size, miked it, finished to dimension with the graduated feed collar, and threaded this end. Then he reversed the piece, turned down and threaded the other end a different size, drilled clean through and countersunk for a union cone. The job would take many a good lathe hand 10 to 15 minutes. Bohaboy's time was 3½.

Starting as an apprentice at a locomotive



CYLINDER CASTING for the horizontal engine on the preceding page is first center-marked with aid of dividers, then gripped in four-jaw chuck with exhaust boss up as at left above and adjusted so that wobbler indicates center mark running true. End that will bolt against crosshead guide is then faced, the casting drilled through and hole brought to size with a reamer or boring bar (center photo). Grooves on faced end are a Bohaboy dodge to insure firm seating of gasket. To machine port face, casting is gripped as at right above. A rod through the bore rests on two chuck jaws to insure parallelism.

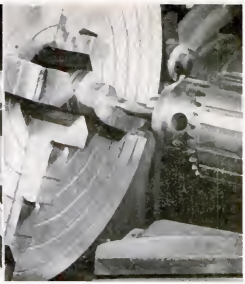


DRILLED FRONT HEAD is clamped to cylinder with a long bolt, holes being aligned to miss steam ports, and used as a jig to drill matching holes in cylinder flange (left above). Dot on rim of each member indexes it for final assembly in same position. Cover is next used as jig to spot similar holes in flange of cross-head guide. Crank disk is turned, tapped and jammed onto threaded shaft, which is chucked for truing outer disk face. Inside face is trued as in center photo, the tailstock center supporting end of the shaft. To drill and tap crankpin hole true, shaft is held in V pad in drill-press vise turned on side (right).

works in Prague, Czechoslovakia, Bohaboy came here in 1912. He went first to the Midwest, where he repaired farm traction engines, tended boilers and served as engineer on a Lake Michigan ferry. During World War I, he was a machinist at the Bliss torpedo plant in Brooklyn, and after that in a shop that built button machinery.

But this lacked the fascination of model engines, for one day the boss caught him building something that had nothing to do with buttons. It was a steam plant for a model boat, and the shop owner, another Czech named Dusha, was so intrigued he asked Bohaboy to build one for his son.

This was Bohaboy's start, for he soon opened his own model-making shop. He designed and built regular and flash-steam plants, as well as such special jobs as an eight-cylinder poppet-valve engine for a 6′ boat and a model of the New York Central's engine 999. He also built a flash-steam plant



FRONT HEAD is critical as it aligns bore with crosshead guide. Casting is held in three-jaw chuck (left), faced off, and stem turned true. A 5/32″ drill is run through, casting reversed and chucked by the stem, other side faced and a shoulder turned to fit cylinder bore closely. Head is then chucked on this shoulder and tail center run into the 5/32″ hole (center photo) for turning crosshead-guide shoulder and scribing bolt circle. Eccentric casting is chucked by its stem to turn and groove body, face end, and spot center. Then it is gripped ¼″ off-center in the four-jaw chuck (right above) to drill shaft hole.

CROSSHEAD GUIDE comes with its bore and flange machined to save kit buyer a tough job. Bearing is scribed with surface gauge (left above), punch mark made on cap parting line, and casting clamped in drill-press vise. To drill bearing parallel to flange face, bent scriber can be used as shown (center). Casting is set so that point touches both sides of flange evenly. Bearing is drilled ¼″, bottom of this and outer bearing filed to align cap parting lines and both parts mounted on base with a ¼″ rod aligning holes. Rod is removed, packing piece jammed in, and setup held against tail center to line-drill 5/16″.

that flew a model plane, and for several years sold compressed-air motors for the same purpose.

The tanks for these were of .006″ shim brass, reinforced with piano wire. He narrowly escaped killing himself on occasions when a tank blew up under test. (His boilers are all pretested with hydraulic pressure, and none has ever given way under steam.) In 1932 he put on the market one of the first model gas engines, a two-cycle job of 1¼″ bore and stroke. Today Bohaboy specializes in steam boilers, engines and castings kits. The photos above show some of the steps a hobbyist might take in machining parts to make a ¾″-bore, 1″-stroke horizontal engine.

To Mrs. Bohaboy's pleas for cleaning up and reorganizing his chaotic workshop, Bohaboy replies it's an organized confusion, in which he can find anything he wants. And sure enough he does. END

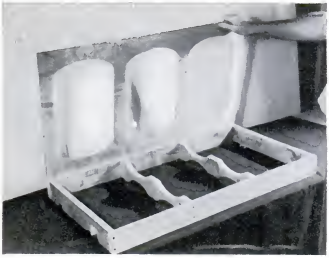
Gauge Measures Inside

SHELVES, stair treads and other pieces that must fit into a blind space can be accurately cut with the help of this telescoping gauge. It also sets the angle of cut to fit the ends of shelves in off-square corners. Cut two ¾" plywood strips and slot their centers so they can slide back and forth to give the required length. A strip on each end pivots on a stove bolt to record inside angles. Wing nuts lock settings while they are transferred to the board.—*John D. Bell, Provincetown, Mass.*

Roller Picks Up Dog Hairs

WRAP masking tape, sticky side out, around an empty orange-juice can and bolt the unopened end of the can to a broom handle. When you roll the can along the floor, hairs and lint are picked up by the sticky surface. When the job is done, unwrap the tape and dispose of it, hair and all. —*Glen F. Stillwell, Manhattan Beach, Calif.*

A Hair Drier Warms My Photo Chemicals



1. THIS WOODEN FRAME puts a hair drier to work keeping my developing chemicals at good working temperature. Trays rest in openings in the top panel. Cut box ribs as shown so heated air circulates freely.

2. HAIR DRIER FITS INTO END of box frame next to the tray for developer, which has the most critical temperature requirements. The drier is not altered and can be removed any time your wife wants it back.

3. DEVELOPING TANKS can be used in the warmer by covering the tray opening with a top cut out to fit. Control temperature of chemicals by switching drier on and off.—*Donald Murphy, Springfield, Mass.*

Photo from Douglas Fir Plywood Association

Storage partition that changes with your needs will hold roomful of clutter in neat array.

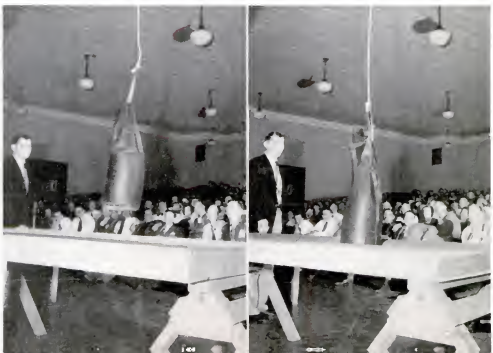
Illinois experts are now omitting studs from storage partitions. Here's how you can use their

New Tricks for Building Walls

By Sheldon M. Gallager

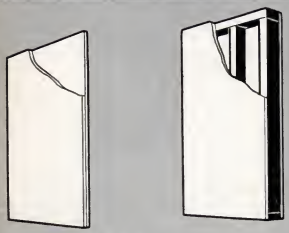
WALLS without studs are the latest gimmick for building simple, inexpensive storage partitions. Because you leave out the wood framework, you save labor and lumber. Because the walls are thin and light, you can put up a unit that will store a host of articles in little more floor space than a conventional wall occupies.

The new walls are simply a thin sandwich of ⅜″ gypsum board bonded to ⅛″

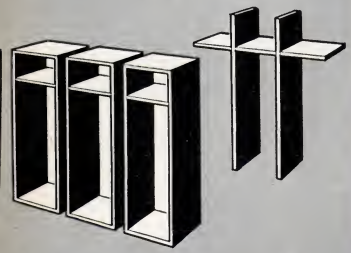


NEW WALL BEATS OLD in tests recently conducted by experts at University of Illinois. At near right, thin, studless panel, developed for use in building closet walls, is undamaged by 60-lb. sandbag that bounces harmlessly off after 4½′ drop. At far right, after only 1′ drop, sandbag smashes right through conventional stud wall.

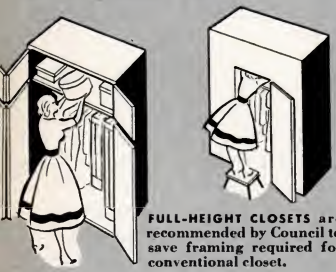
Save Space and Money



THIN, STUDLESS PANELS, only ½" thick, cost less, save 4½" over conventional wall.

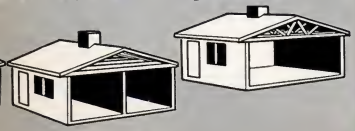


BY USING EXISTING WALLS, where possible, to help frame closets, you need fewer partitions (right) to give same storage space as individual cabinets put side by side.



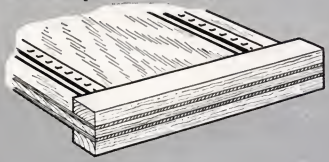
FULL-HEIGHT CLOSETS are recommended by Council to save framing required for conventional closet.

TRUSS ROOF (right), found in many new homes, is self-supporting, permitting use of studless, nonload-bearing walls.



Panels Are Made

BACK PANELS, used to face rear of closet, are made of ¾" gypsum board cemented to ⅛" hardboard with linoleum paste. Half gallon of paste is applied to 4'-by-8' sheet of hardboard with notched spreader, then 4'-by-8' gypsum sheet is laid on top. Panels are weighted and allowed to dry 24 hours. For damp areas a waterproof cement is used.



DIVIDER PANELS, used to partition closets, can be made of ¾" plywood or a frame of 1"-by-4" stock covered on both sides with ⅛" hardboard. Panels are cut ¼" short at top so they'll fit easily in place, and 1"-by-2" cleats are nailed to bottom to form base. Adjustable shelf supports, called pilasters, are fastened to dividers before panels are put up.

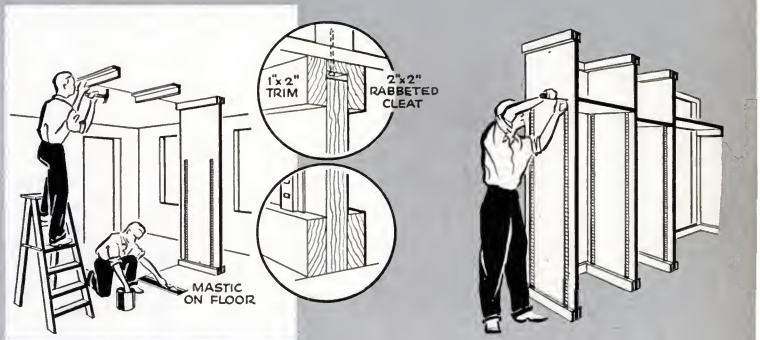
hardboard. The tough, resilient hardboard gives the slim panels tremendous strength. Narrow uprights placed at right angles to these panels provide support.

The walls, developed by the University of Illinois Small Homes Council under a Lumber Dealers Research Council grant, are described in two recent circulars.*

"Storage Partitions" (a descriptive pamphlet) and "Construction of Storage Partitions" (a detailed instruction sheet) available from Illinois Small Homes Council, Urbana, Ill., at 10 cents and 25 cents respectively.

How Panels Are Used to Make Closet Walls

LAYOUT OF CLOSET is first outlined in room to show positions of panels. Starting at floor, line is marked in where back panels fall (left). Then divider panels are marked in at right angles to back-panel line with carpenter's square (center). Floor plan is then transferred to ceiling (right). Ceiling lines are located by dropping plumb line to floor.



NOTCHED CLEATS hold divider panels at ceiling (left). If saw is unavailable for rabbeting, cleats can be made from two wood strips. Panels are then set in mastic at floor, nailed to cleats at top, and fixed shelf is screwed between to form rigid box (right). Cleats are also nailed between dividers as nailing surface for back. (Please turn page.)

How panels are used. The bonded sheets, which act as back panels, are used to face the rear of a closet where the unit is not placed against an existing wall. This provides a gypsum surface on the outside to match the regular plaster or plasterboard walls found in most homes.

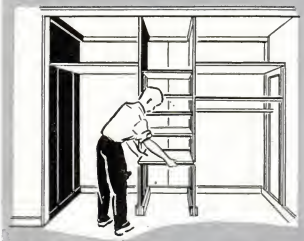
To brace these back panels, narrow divider panels are erected at right angles to them. The dividers, spaced up to 4′ apart, are put to work as side walls for closets and vertical partitions within the storage walls. Where a closet is built against an existing wall, no back panels are needed.

Walls save space. Because the closets are built without studs, they utilize floor space that a stud wall would waste. A 12″ studless storage wall, for instance, is only 7″ thicker than a conventional 5″ stud wall. Divide this between the two rooms that the closet separates and you are actually taking only an extra 3½″ off each room.

They're flexible. Before each divider panel is put up, it is fitted with adjustable

How Closets Are Built

BACK PANELS ARE NAILED, gypsum side out, to edges of dividers and cleats at floor and ceiling. Where panels meet, sheet-metal splines hold joints in line.



ADJUSTABLE SHELVES are placed on brackets set to any desired level. Clothes pole hung from shelf moves quickly up or down. Drawers can also be fitted in.

FULL-HEIGHT DOORS give greatest access to closets, can now be bought in stock 8′ lengths and several widths. Sliding and folding types take least space.

supports, pilaster shelf standards. Once in place, all you do is hook in metal tabs and slip in boards for shelves. One fixed shelf is screwed to the divider panels near the top to provide a rigid box-type construction, but the rest of the shelves can be quickly shifted around as desired.

In new homes where the roof is a self-supporting truss that does not require load-bearing partitions, the thin-wall closets can be used in place of partitioning walls. In older homes, the closets can be placed against any wall or used free-standing.

How deep to make them. You can make your closets as deep (front to back) as you like, but the recommended depths are 12″, 16″ and 24″. Sticking to these lets you slice an exact number of divider panels out of standard 4′-by-8′ sheets of hardboard or plywood with a ¾″ glued up lumber core. With the 12″ depth, you can use 1″-by-12″ boards.

Finishing. The back panels are patched at the seams with tape and cement just as on regular walls of gypsum board (see "How Anyone Can Plaster," PSM, Jan. '54, p. 203). The panels can then be painted or wall-papered to match the room. Dividers should be primed before painting, or shellacked for papering. Add molding and baseboard and you have a finished closet wall. END

ALTERNATE METHOD of constructing closet shows how flat spacer boards are used to hold divider panels at top and bottom in place of cleats. Back panels can be put up horizontally for closet that faces two ways.

Outboard Works as Pump to Extend Skating Season

When heavy snows fall, skating usually comes to an end. But not so on one Wisconsin lake this winter. There, outboard motors are being used to pump water from under the ice, flood away the snow and form a new, smooth coating of ice.

"We skate all winter and never use a shovel except to bank a little snow around the hole we chop in the ice," says Elmer H. Smith of Minneapolis.

"We use a 7½-hp. outboard motor and fasten two lengths of 9″ galvanized stovepipe to the cavitation plate. (The end of one pipe is slit and bolted to the plate.) The 8″ propeller gives considerable thrust so we put on a brace. Then we fasten the motor to a two-by-four about 4′ long and set the apparatus into a hole so the propeller is submerged about 4″."

The conductor pipe throws water over snow banked around the hole to keep water from backing in. Smith and his friends use two holes and have a skating area about 100 yards wide and 150 yards long.

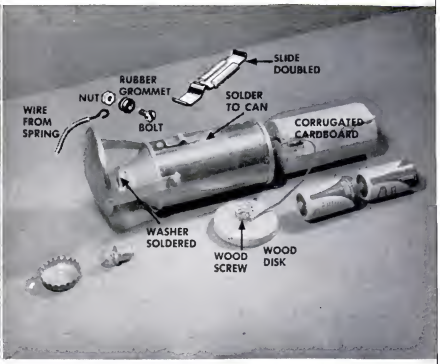
Table Saw Gets Sanding Disk

A disk cut from ¾″ plywood and covered on both sides with sandpaper converts your table saw into a disk sander. The saw table also provides a larger area of support for the work than the regular disk-sander table.

Glue a 40- or 50-grit paper on one side of the disk for fast cutting and a finer grit on the other side for finishing. When dry, cut the center hole clear with a knife.—*Gordon D. Carlson, Minneapolis, Minn.*

9 Uses for Beverage Cans

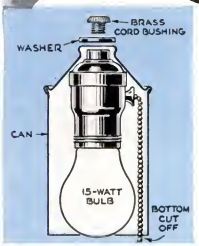
These containers are easy to solder if scraped to bare metal, they take enamel nicely and their wax lining retards rusting.



1 STAND-UP FLASHLIGHT made from 6-oz. can uses prefocused 3-volt bulb and two C cells in cardboard jacket. Cut out can bottom and screw in wood disk to which a coil-spring contact has been bolted. Make 3/8" hole in cap and fit over bulb flange. Flange rests on washer soldered atop can neck. Reflector is bottom of 12-oz. can, pivoting on strips soldered to can. Melt wax from reflector. Center post of top cell touches bottom of bulb. Wire from coil spring goes to insulated screw. Switch grounds it, lighting bulb.

2 TOY ROLLER is made by soldering two cans together and bending coat hanger around necks. Cap cans after putting in pebbles. Loop in wire makes a handle.

3 FOOTSTOOL, flowerpot shelf, play table or step a child can use to reach washbowl is made in a jiffy. Attach cans by running screws through wood into bottoms.



4 TROUBLE LIGHT or power-tool lamp calls for cutting can near the bottom. Tape sharp edges. Photo shows bayonet socket and wire loop held with two nuts. Wire has plug to fit auto cigarette-lighter socket. For home use, mount 115-volt socket with a washer and cord bushing as shown in the drawing.

5 GAY CANDLESTICKS for informal parties are an easy project. Paste or tape colorful wallpaper or gift wrapping around cans and pour in sand to keep them from tipping.

6 STEAMBOAT WHISTLE is a good party favor. Solder short brass tube to neck at angle found by trial. Add spool mouthpiece. Brace (dotted) makes toy more durable. To raise pitch, pour in water.

7 BOY'S DUMBBELLS are two 12-oz. cans on a 14" piece of ⅜" dowel. Partly fill cans with sand or wet plaster, push them on dowel and run screws through can bottom into dowel. Tape necks to avoid loss of sand, and wrap cord around the dowel for a better grip.

8 SALT SHAKER for picnics, (right below) is can with pierced foil held by cap with hole in it. Rubber reseal cap, with drilled hole, makes can a clothes sprinkler (left).

9 MUSICAL GOURD has pebbles in it to make the sound. Wrap dowel with tape to fit tight in neck and fasten with a wood screw through the can bottom into the dowel.

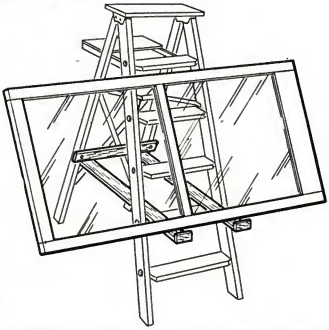
Homemade 200-Amp. Welder Is Driven from Farm Tractor

WELDING JUICE follows the tractor with this mobile farm rig. Leonard F. Pompe, of Whittemore, Iowa, built a trailer of angle iron and an auto axle On it he put a 200-amp, war-surplus aircraft generator, with an auto drive shaft to the tractor's power take-off.

DRIVE SHAFT TURNS a 16" three-groove pulley running on ball bearings. Triple V belts drive 2½" pulleys on the generator, which is mounted to slide on the trailer cross members. Belt tension is adjusted by drawing up bolts that pull the generator back. The usual universal joints at the ends of the shaft take up any small misalignment between tractor and trailer. The reactor, rheostat and generator shunt are also mounted on the trailer.

Drill Marks Wiring Passages

When wiring outlets in an old house it's a mean job to measure where to bore inside a wall to grab a wire from another floor. It's usually easier to pry up the base shoe and make a marker hole through the floor and ceiling to the next level. The small holes are easily plugged and concealed later.—*O. A. Nelson, Seattle, Wash.*



Ladder Holds Sash for Painting

You'll save your back when you paint screens or storm windows if you turn a step-ladder into an easel. Attach a board across the back of the ladder and screw under it the ends of two boards placed on the ladder step. Screw blocks on the ends of the supports to keep the window from slipping.—*Robert Walsh, Wakefield, Mass.*

KEEPING THE *Home* SHIPSHAPE

A disposable apron for jobs such as painting can be made from newspapers. Tie a string around your waist and drop a section over it. When splattered, tear off a page for a clean surface.

For a pickled finish on natural wood, apply lead or zinc white diluted with gum turpentine, rub with a soft rag until the effect is pleasing, then wax well, or finish with a coat of shellac.

A flip-up cover made from canvas or plastic lets you stand on an upholstered stool without marring it. Put a hook opposite tacked end so flap tucks away when not in use.

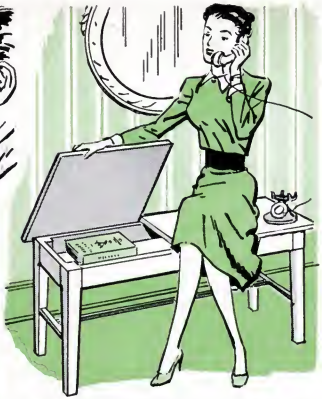
Save the wrappers from bars of margarine. They make handy covers for small dishes of leftovers, being stiff enough to crimp over for an airtight seal.

When driving screws in hardwood, drop some soap powder into the holes. The screws will turn easily all the way in, which they may not do if soap is merely rubbed on the threads.

Please turn the page for more home tips.

More Home Tips

Rack up small tools in workshop or kitchen by stringing up a coil-spring curtain rod, then anchoring it at several spots with double-headed tacks.



A gossip bench for telephoning can be made from an old piano bench. It will hold the phone, store the directory and seat you comfortably while you chat. Cut the lid in half so you can lift it to get at the book without moving the telephone.

Tilt cupboard shelves to store cans on their sides—selection will be easier, weekend inventory a cinch and you may even find you can store more. As a can is removed, the whole row rolls forward to a stop strip, labeled for easy checking.

Ladder boots, cut from tire casing and nailed to the legs, will prevent skidding on a smooth surface. To keep the upper ends of the ladder from sliding, wrap them with bands cut from inner tubing.

Brighten up a dark room by rigging it with mirrors. Besides hanging a wall reflector opposite the windows, fix mirror strips on window sills to bounce more light to the ceiling. Insert the strips in sill molding or cement them in place.

UHF Converter Updates Your Set

For $20 or less you can make it pull in those new channels sprouting all over the map.

By Don Holm

UHF television is coming your way, if it's not already there. Over 250 new stations were licensed in 1953 and more are coming. UHF reception, which covers channels 14 to 83, is superior in many ways to the familiar VHF of channels 2 to 13.

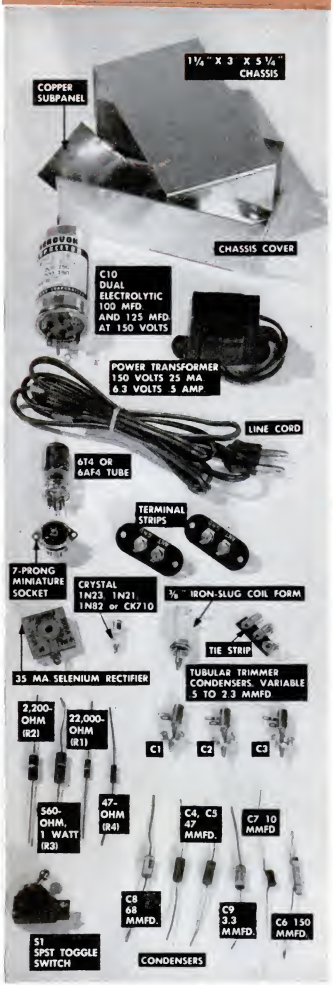
There's no need to miss the new stations just because your old set won't cover them, nor to shell out for a new all-channel receiver. A homemade converter and a UHF or a combination antenna will bring your present set up to date. With it you can get static- and interference-free UHF broadcasts without impairing your enjoyment of the channels you now use.

It started in Oregon. When channel 27 went on the air in Portland, Ore., in 1952, it was not only that city's first TV station, but the first commercial UHF installation in the world. Ordinary VHF sets wouldn't get it, and with commercial converters worth their weight in back orders, Portland's radio hams and experimenters put many a homemade one to work.

One of the best of these was designed by Charles Glen Rose, W7OAY, a former Navy and Air Force radar specialist. You can build the same unit in a couple of evenings for $15 or $20 (depending on how many parts you can scrounge from the junk box).

How the outfit works. The unit is stable and drift-free, broad-banded and critical only as noted. It can be tuned to any

The Parts You Buy

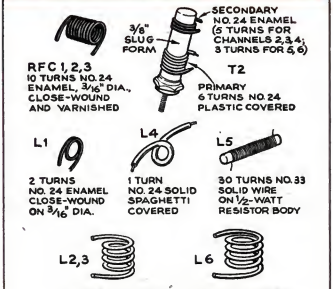


UHF channel from 14 to 71 without plug-in coils (you can forget about channels 72 to 83 for some time to come). No instruments are needed for alignment, no special TV knowledge required.

You tune the converter to the UHF range desired by winding the proper coils as an integral part of the circuit. These are nothing like the coils you wound for your first radio, for most UHF inductances have amazingly few turns—in fact, the L6 coil for channels 56-71 is a straight piece of wire ¾" long! You can wind all the coils needed in a short time. But don't improvise by using different wire or changing coil diameters; stick to the specifications.

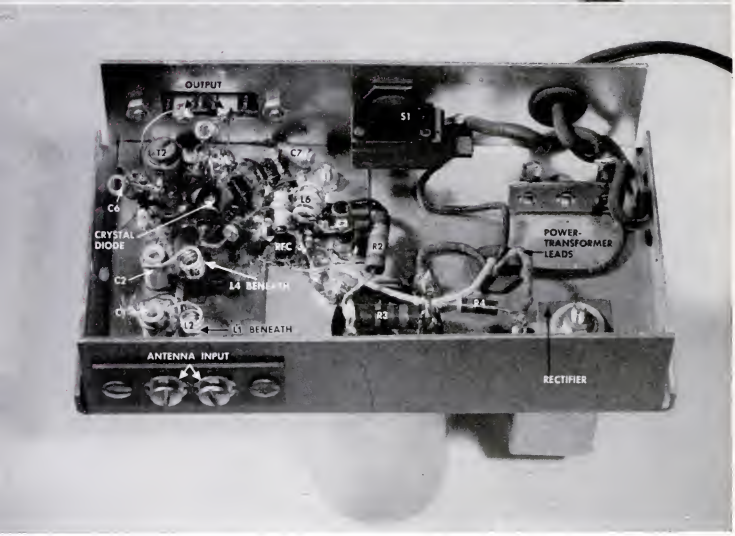
Technically speaking, this converter has two stages of tuned pre-selection, which are stagger-tuned for a six-megacycle band width to the UHF channel frequency. This is then converted to the carrier frequency of an unused channel on your VHF set by a one-tube oscillator and a diode mixer. The output signal is fed into your VHF set through the antenna terminals. There is no danger of harming or misaligning your set, and to go back to the ordinary VHF chan-

The Coils You Make

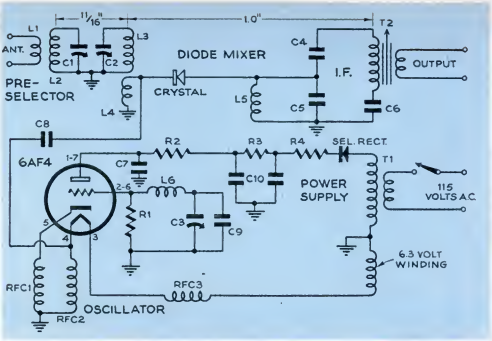


UHF CHANNELS	COILS L2, L3	COIL L6
14 TO 29	4 TURNS	4 TURNS
28 TO 43	2½ TURNS	2 TURNS
42 TO 57	1 TURN	1 TURN
56 TO 71	5/8" LENGTH BENT TO HAIR-PIN LOOP	3/4" STRAIGHT LENGTH NO. 18 SOLID

The Way It's Put Together



How It's Wired



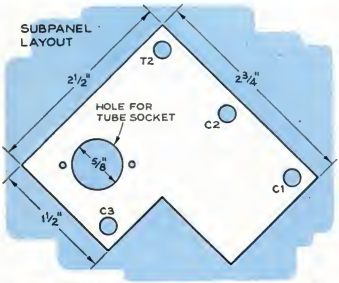
WATCH POLARITY when wiring crystal diode and selenium rectifier. If either is hooked up backward, unit will not work. Most diodes are marked with arrow and bar (bar stands for the cathode). Plus sign on rectifier marks terminal to go to R4.

nels you simply hook the antenna back directly instead of through the converter.

Stick to the layout. At frequencies for which a straight piece of wire can serve as a coil, a slight rearrangement of parts can cause unpredictable effects. Better lay out the chassis and subpanel exactly as shown, for this arrangement works.

Mount the power transformer T1 on top of the chassis and run its leads through a rubber grommet. Attach a tie strip under one transformer-mounting nut and the selenium rectifier under the other.

Mount the switch, antenna terminal strips and electrolytic condenser C10. Solder resistor R3 across the two positive terminals of C10. Mount the tube socket with prongs 1 and 7 toward the switch.



COPPER SUBPANEL cut from flashing copper or even foil facilitates wiring and assures good ground connections. Be sure to solder copper to the set chassis at several places.

Cut the subpanel from common roofing or flashing copper or even copper foil, and punch (or drill and file) holes for the tube socket and tuning screws as in the drawing. Tin the copper where connections will be soldered.

Keeping all leads as short as possible, wire the power supply first. Run the AC power cord through another grommet and solder one wire to the tie strip, the other to the switch. Then connect the transformer primary (black leads) to the tie strip and the other side of the switch.

Wind coils on a nail. The chart gives all coil-winding data. For L2, L3 and L6, wind only the coils needed to cover UHF channels in your area. The small coils can be wound around a nail. Solder the top ends of L2 and L3 to C1 and C2, being sure the turns go in the same direction. Solder the lower ends to the ends of a 1/16"-by-11/16" strip of thin metal, and solder the center of this to the subpanel as a common ground. This is a critical assembly. In all the tuned circuits, use little solder, and if possible no flux.

The link coupling, L1, is mounted by soldering its ends to the antenna input terminals. The coil should be as close to L2 as possible and concentric with it.

Assemble and solder the rest of the preselector stage on the subpanel, bonding the copper subpanel to the chassis with solder at several joints. The tuning screw of T2 must extend through the chassis, like those of C1, C2 and C3. The distance between T2 and L3 is critical; it should be exactly 1".

Wire up the crystal-diode mixer stage

next. Mount the single-turn link coupling, L4, directly under L3. Use caution in soldering to the crystal as it may be damaged by excessive heat. Wire the oscillator stage last, being careful to place the RF chokes RFC 2 and RFC 3 at right angles to RFC 1. Keep all leads as short as possible. Tweezers will help in this close work.

Tuning the circuits. Check all wiring for shorts and errors. Test the tube beforehand if possible. Connect the UHF antenna to the pre-selector input terminals, and the output of the converter to the antenna terminals of the set, with 300-ohm twin lead. Plug in and turn on the converter.

Tune the set to an unused channel of the 2 to 6 group. Then tune the converter oscillator by adjusting C3 until a video and sound carrier is received. Next tune the pre-selector by adjusting C1 and C2 for best sound and best picture. Peak up the IF section by adjusting T2 for best reception.

Finally, bring sound and picture to best reception on the regular set controls. To go back to VHF channels, simply turn off the converter and reconnect a VHF antenna to the set terminals.

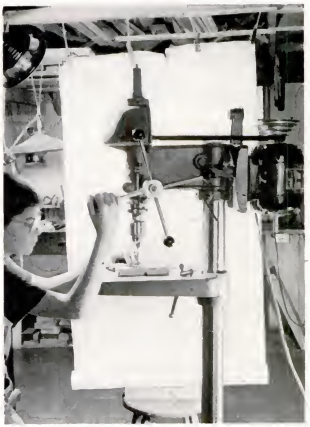
If it doesn't work. If the converter has been properly wired it may work at first try. If the stations do not come in, the following checks are in order.

Check the tube for oscillation if possible. Often even a new tube will not "kick off" and work efficiently. You may have to try several. Oscillator frequency may be off because of too much capacitance in the circuit; try disconnecting C9. A tube shield or overly long leads may throw off oscillator or IF frequency. Make sure L1 is as close to L2 as possible to obtain sufficient band width. Try an adjacent VHF channel, running the fine tuning control through its full range.

You may not be getting enough UHF signal. A combination antenna may work in favorable locations but not in others. Best results will be gained with a special UHF antenna.

A last trouble-shooting resort, if you are sure the antenna is delivering and the oscillator is putting out a beat frequency, is to connect the UHF antenna directly to the crystal diode and ground. If this works, something is wrong in the pre-selector.

Once the converter is working, the superior quality of UHF reception will repay your efforts, besides extending the useful life of your present set for quite a time. END



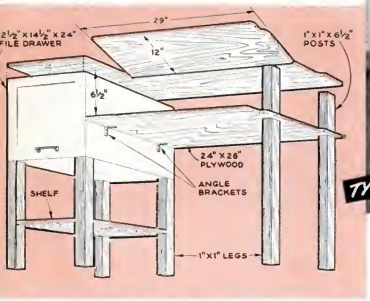
Wallpaper Is Photo Backdrop

IN SNOP photography, cluttered backgrounds can muddle your photo. A roll of plain wallpaper will make a fine backdrop. I hang mine with clothespins on the end of strings. At the bottom, the roll rests in a V block. Light the subject normally, but pour lots of light on the backdrop. In the finished print, mask out everything outside the backdrop.—*Walter Haase, Hartford, Conn.*

Lacquer Restores Old Rules

IF THE markings on a steel square are illegible, you can bring them back to life. Wire-brush off any rust or scale, sandpaper the steel bright and wipe it clean. Then coat the entire square with black lacquer. When dry, sand the lacquer off the smooth part. It will remain in the engraved markings.—*O. A. Nelson, Seattle, Wash.*

One Evening Shop Projects



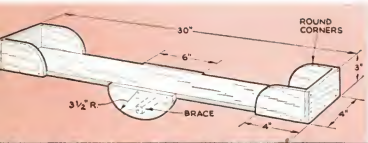
FOR TYPING, part of the desktop folds back. Books behind support it at a convenient angle for reading copy clipped to it. A good-sized flat surface is made available by dropping the panel without moving the machine.

Starting with a file drawer mounted on legs, you can build this handy typing desk tonight—and still have time left over to write your best gal a letter.

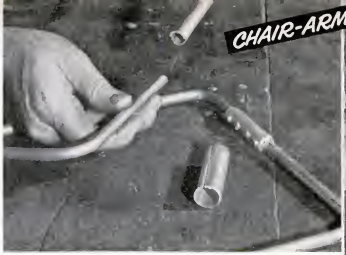
If you don't already have a file drawer, you can probably buy one at a secondhand shop. Mount it on 18″ legs with a shelf between.

For the bottom shelf of the desk, attach a piece of ½″ plywood to one side of the drawer and support the free end with legs. Then saw a 29″-long section out of one corner of a 24″-by-43″ plywood panel and hinge it along the cut. Fasten the panel to the file top and a 6½″ corner post at the rear. The hinged part rests on ½″ of the drawer and a second post at the right-hand corner.—*D. Macarov, Pittsburgh.*

The doll family can have its own seesaw at the cost of an hour's work and some scrap lumber. For this one, the rockers were jigsawed from ¾″ plywood, the seats from ¼″ plywood. A 3″ length of scrap about ¾″ square braces the rockers. The pieces are assembled with light nails.—*Bill Cartwright, Pittsford, N. Y.*

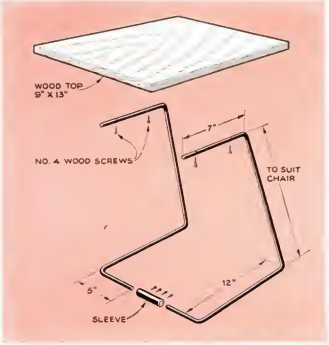


The right knife is always handy in this rack, and keen edges are protected. Cut shallow dadoes in a board, or file between parallel saw cuts, to form pockets for the blades. Screw this piece to a slightly longer board and attach to a cupboard side, door or wall. Drive escutcheon pins into the long board to support the handles.—*E. Britt, Westport, Conn.*



ROD CAN BE JOINED with a sleeve made from ¾" aluminum tubing. Cut the piece lengthwise, wrap around rod and drill through the overlapping thicknesses into the rod. Use two rivets or drivescrews to hold each rod.

CHAIR-ARM TABLE



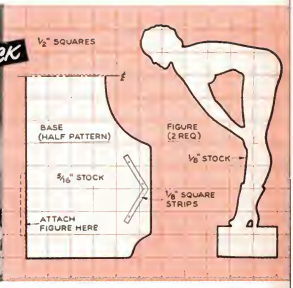
Big enough for a writing pad, a snack tray or a couple of books, this pickup table can be made from ⅜" aluminum rod now available in hardware stores.

Bend the frame in two halves. Clamp the rod tightly in a vise with the desired bending point ¼" outside the jaws. A piece of ⅜" gas pipe slipped over the protruding part as a lever will aid in obtaining sharp bends. Correct slight errors by hammering. Do not try to rebend or the rod will crystallize and break.

The two halves can be joined by driving them into a tight-fitting piece of pipe and securing them with rivets or drivescrews. A sleeve also can be shaped from oversize tubing (see left above).

Your pipes may not taste sweeter, but they'll look better held by these pin-ups. Cut the silhouettes from thin stock, the base from thicker material. Brad short strips to the base as pipe rests. Attach each cutout with screws. Varnish all over, or give the base a natural, and the figures a black, finish.—*Clifton Morris, Lubbock, Tex.*

PIPE RACK



Traveling is simpler if you have

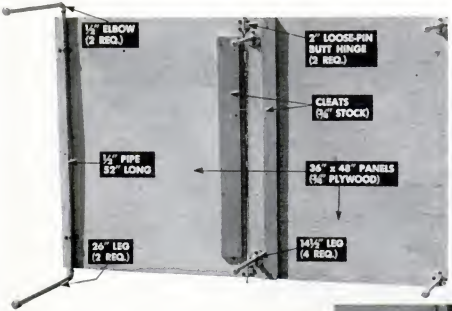
A Double-Deck Station Wagon

Luggage can be kept under this easily made sleeping platform.

AS LOTS of people are discovering, station wagons can haul an immense amount of luggage and can also be converted to provide a long, flat deck in back. But they cannot do both at the same time. To use the rear floor for sleeping, you must restack the luggage at night or put it on the roof, where it may get wet or be stolen.

We found a way to have our cake and eat it too. The solution consists of a pipe-supported platform or sleeping deck of ¾" plywood, high enough off the floor to let a foot locker or standard suitcase slide underneath, but low enough to be below the window sills and the back of the front seat of our '53 Mercury. For easy handling, the platform is built in two halves, attached by loose-pin butt hinges.

This arrangement lets us use the center seat of the station wagon for passengers during the day. Luggage is stowed under the rear deck section, on which the front panel is laid for traveling. At night the center seat is folded down and the front panel erected by screwing on the forward legs and slipping in the hinge pins. Covered with air mattresses, the deck so formed makes a fine bed for two adults or three youngsters.—*W. B. Bernard, San Diego.*

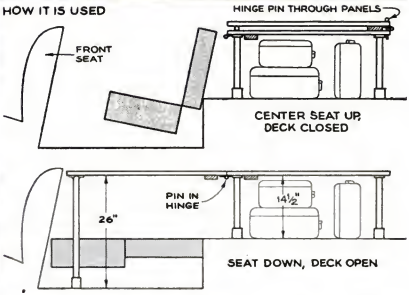


BOTTOM VIEW of assembled deck. Cleats may be any available ¾" stock. Front pipe crosspiece is mounted with cable straps; other ½"-pipe legs screw into floor flanges. Panels are joined by a pair of loose-pin butt hinges, one leaf of each being attached to each panel. Hardware is mounted with ¼" carriage bolts.

WITH PINS REMOVED, hinges separate to permit stacking front panel on top of rear one, the 26" legs being unscrewed from elbows. To prevent top panel from sliding off, hinge pins go into holes through both panels near rear edge. Crutch tips protect car floor.

FOR DRIVING, one deck panel lies on the other, leaving the center seat available. All the luggage shown here can be stowed under the back panel section, accessible from rear.

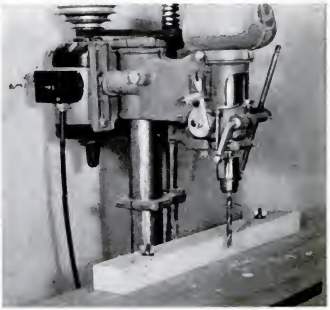
FOR SLEEPING, center seat is dropped, top deck panel slid forward, front legs screwed into elbows and pins put in hinges joining panels. Rear luggage need not be moved.



Homemade Maple Table for Drill Press Handles Long Work

BUILT up of ¾"-by-1½" strips of maple glued together, this 12"-by-72" table presents a smooth, flat surface to support long woodworking projects for drilling.

Four countersunk ¾" flathead machine bolts and nuts secure it to the slots in the drill-press table. A maple insert piece, ¾" thick, is set flush in the center of the table directly beneath the spindle. When it is chewed up by drills passing through the work, it can be replaced with a fresh plate. A maple fence held in place by two wing nuts is handy for shaping, routing or in-line drilling. Slots for the bolts permit quick adjustment. Rows of holes across the table are for bolting stops and jigs to it.—*Gordon D. Carlson, Minneapolis.*



Kits Keep Cellar Shipyards Booming

A kit this winter can mean a boat next summer. Here are some sleek models for '54.

1. BIGGEST KIT-BUILT BOAT, says maker, is this 31′ cabin cruiser. Hull kit costs $1,675; cabin

GONE are the days when only hardy eccentrics and small boys dared build their own boats in the face of the experts' warnings. Today, home shipyards are springing up wherever there's room to lay out the frames. Boat kits, with precut parts and complete instructions, offer everything from tiny prams to 31′ cabin cruisers.

Whether you want to race a small sloop or a churning hydroplane, shoot ducks or troll for bass, take your family on a week's cruise or your girl for a spin, there's a kit boat to meet your needs. Outboard types predominate, but there are more and more kits for inboard power. Sailing-craft kits, however, are lagging except for the small prams.

Guided by thousands of users, manufacturers are making their kits easier to build. Some kits now come in shipping crates that double as jigs to hold the frame. A New England builder includes corrosion-proof Monel fastenings. Glass-fiber bottoms, immune to rot, are offered as extras.

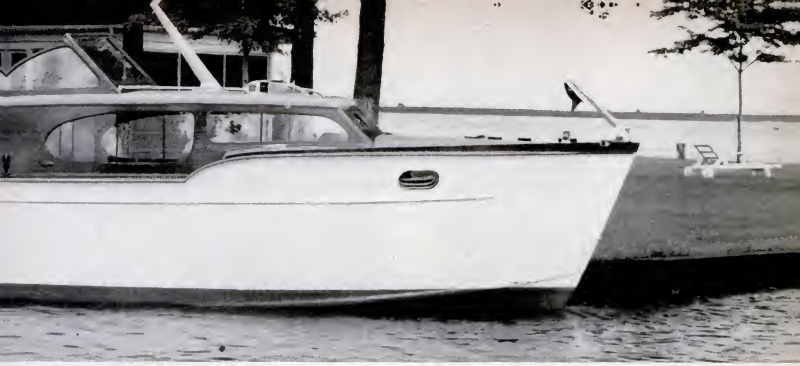
If you're in the market, note carefully, in comparing kit prices, just what is included. Some kits provide everything; in others, paint and even hardware are extras. Marine-paint makers are getting in on the act with paint kits matched to specific boat kits—just enough for one boat of all the kinds of paint needed.

Here are some of the latest kit-built boats you'll see afloat this summer. Right now they are part of the great fleet a-building in cellar shipyards all over the country.—*Hartley E. Howe.*

Further information about the boats pictured can be obtained from: 1. Chris-Craft Corp., Boat Kit Division, Algonac, Mich.; 2. Doane Marine Works, Shippan Point, Stamford, Conn.; 3. Custom Craft Industries, 1700 Niagara St., Buffalo 7, N.Y.; 4. Ozarka, Inc., Washington and Borden Lane, Woodstock, Ill.; 5. Acme Boat Co., Miamisburg, Ohio; 6. Luger Industries, 3207 Fremont Ave. South, Minneapolis 8, Minn.

3. CONVERTIBLE, deep and beamy, offers plenty of room in its 18′. The folding top, an extra, has zip-on side curtains to enclose the cockpit. There are kits for both inboard and outboard types, costing around $400. Paint and hardware are extra.

4. UTILITY OUTBOARD is a planing type with a modified V bottom. Designed for hunting and fishing, it can be driven by a small engine for trolling if desired. Large seats and leg room offer day-long comfort. Kit, including paint and varnish, costs $154.50.



kit, including windshield, flooring, $635. It takes either single or twin inboard engines. Space is provided for dinette, galley, head, wardrobe, two berths.

2. CHEAPEST CABIN CRUISER in the world is the claim made for this 14′ job that sleeps two. There are models for either outboard or inboard power plants in the five-to-16 hp. range, providing speeds up to 25 m.p.h. Precut kit with glass-fiber bottom is $269.

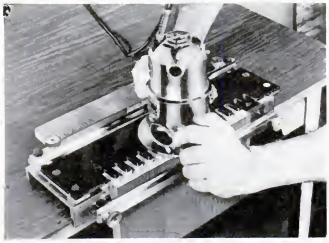
5. SEMI-V-BOTTOM RUNABOUT is fast yet sturdy for easy handling in rough water. Thirteen feet long, it is said to have speeds up to 50 m.p.h. with a 25-hp. outboard. Kits are priced from $165 according to decking and spray rails provided. Paint is extra.

6. CENTER-DECK 14′ RUNABOUT, shown with 12′ sister in background, comes either as $147 de luxe model below, or slightly cheaper open type. Boat carries six passengers, steers from remote-control wheel forward. Kit provides fir-plywood panels, oak frame.

New Tools

1. Level Guaranteed Shatterproof. This 24″ plastic level is built for a beating. The frame is plastic and the bubbles are molded into vials of protective clear plastic. The whole tool weighs 12 oz. The maker offers a new level if one should be broken in normal use.

2. Jaws Help Vise Grip Pipe. Pipe from ⅛″ to 2″ in diameter can be held in an ordinary vise with these adjustable jaws. A spring holds them in the vise.



3. Template Used with Router. This new template lets you use a hand-held electric router to cut dovetail joints with factory efficiency. An aluminum frame holds the two boards at right angles so the matching joints are cut at the same time. A template of laminated plastic, clamped on top, guides the router. Templates are available for either ½″ or ¾″ dovetails. The device handles stock up to 12″ wide and from 5/16″ to 1″ thick.

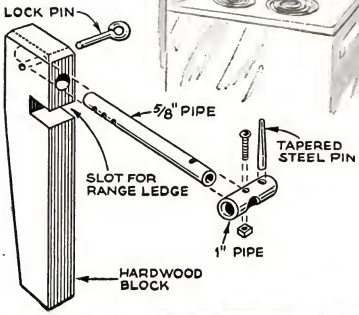
4. Flashlight Tests Circuits, Too. You can quickly check fuses, lamp cords, motor windings and other household wiring with this combination flashlight and tester. Two clip-on leads plug into the base and use power from the batteries for testing circuits with the house current shut off.

Further information on these products can be obtained from: 1. Creative Plastics Corp., Stony Brook, Long Island, N.Y.; 2. H. A. Johnson, P.O. Box 62, Fruitvale Station, Oakland, Calif.; 3. Porter-Cable Machine Co., 28 Exchange St., Syracuse, N.Y.; 4. The Gadgeteers, 3031 Fullerton Ave., Chicago.

Wood-and-Pipe Bracket Holds Mixer

A BRACKET to hold the electric mixer in working position over one of the stove burners makes it easier to cook foods that require frequent stirring.

This one consists of a hardwood block screwed to the range and bored for a supporting arm—a length of 5/8″ pipe. The mixer hangs on a tapered pin driven into a hole drilled in the side of a short piece of 1″ pipe. This pipe is drilled to slip over the arm at right angles and is bolted to it. A lock pin holds the arm at several positions in the mounting block. A plastic bottle cap closes the end of the arm to make a neat-looking job.—*Arne O. Salonen, Raymond, Wash.*

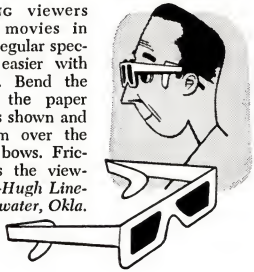


Suede Brushes Clean Iron Tip

BRUSHES sold for cleaning suede shoes will do the same for a soldering-iron tip. Glue two on edge to angled wood blocks. Nail the blocks to your workbench or the iron carrier. Draw the hot tip through the brushes to clean it.—*Ken Murray, Colon, Mich.*

3-D Viewers Bent for Spectacles

KEEPING viewers for 3-D movies in place on regular spectacles is easier with this trick. Bend the bows of the paper viewers as shown and hook them over the spectacle bows. Friction holds the viewers tight.—*Hugh Lineback, Stillwater, Okla.*



Asbestos Shingle Shields Torch

A SCRAP of asbestos-cement shingle—the kind used on house exteriors—makes good fire protection when you use a torch near studs or joists to sweat a joint in copper plumbing. Usually the pipe will hold the shingle against the wood.—*Lucien R. Greif, Thornwood, N. Y.*

Bent Wire in Drill Stirs Paint

To STIR paint, a workman I know chucks a piece of heavy wire in his electric drill after first making a right-angle bend on the end. For gallons he uses a 12″ wire with a 2″ turn, for smaller sizes 8″ with a 1″ turn. —*L. C. Auer, La Porte, Tex.*

Homemade

Electric Drill Runs This One . . .

For every hour you put into the building of one of these power planes, you'll get back two when you use it.

BUILD one of these power planes and you can say good-by to the old washboard drudgery of planing wood. Spinning rotary blades shave as much as ⅛″ off the wood in a single pass. You can fit a door or storm sash in jig time.

One of the planes gets its power from a ¼″ electric drill, the other from a flexible shaft driven at 1,725 r.p.m. by a quarter-horse motor.

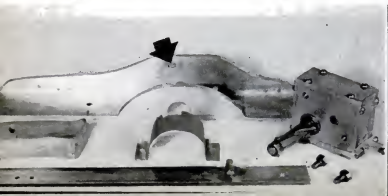
Which should you build? The electric-drill plane is an all-metal job built by John Rogers of Dallas, Tex. It is ideal for ordinary use in a home shop. A step-up gearbox that multiplies the drill speed provides smooth cutting. It is light and gets into tight places where there's little room to swing a hand plane.

A hardwood block forms the body of the second plane, built by Bradford Dittmer of

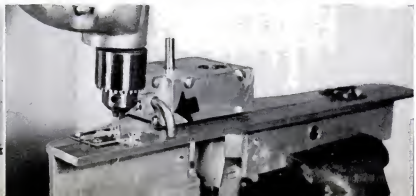
FIT ARCH BRACE to body of frame before cutting opening for cutter blade, to insure perfect fit. After fitting and threading screw holes, disassemble and finish cutting. Countersink holes for 8-32 flathead screws so they can't score work when plane is in use.

GEARBOX houses 36-tooth drive gear (Boston Gear Works No. G 261) mounted on ¼″ shaft riding in two bronze bushings. Driven gear (16-tooth Boston No. H 2416) turns on 5/16″ shaft and two ball bearings (New Departure No. 77038).

READY FOR ASSEMBLY. Mounting holes (arrow) should be elongated slightly to provide means of adjusting depth of cut or correcting small errors made in fitting parts.

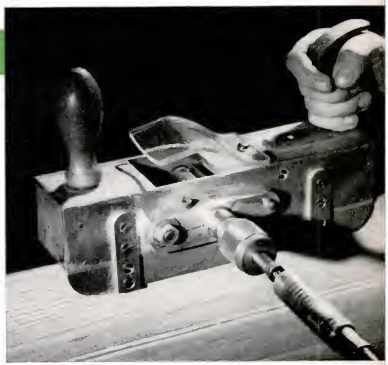


ATTACH BEVEL GUIDE to frame with two hinges. Bend adjusting arm (arrow) from ¼″ bolt to form quadrant that slides in bracket on gearbox. Setscrew in bracket locks arm.



Power Planes Shave Wood and Time

. . . A Flexible Shaft This One



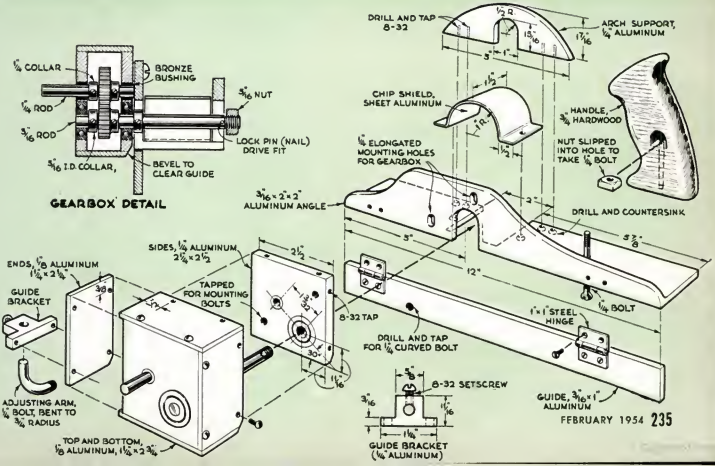
Bellmore, N. Y. Its huskiness makes it useful for heavy work—boatbuilding or smoothing rough lumber. A curved-bottom version of this plane is useful for shaping concave chair seats or planing contoured edges.

Some metalwork must be done to fit the bearings for the cutterheads in both planes. A drill press is practically a must to assure accurate holes. Other steps in the construction can be completed with files and a hacksaw. Cutterheads can be bought at any large hardware or power-tool dealer's. Write to Boston Gear Works, 480 Canal St., NYC, for gears and bearings.

Electric-Drill Plane

SHAPE one side of a piece of dural angle, as in the drawing below, to make the backbone of the plane. All parts, including the gearbox, are attached to this. Fit the arch brace to the angle before cutting the openings for the cutterhead or its shaft, and tap the holes for the flathead joining screws. This insures that these parts will fit in true alignment *after* the openings are cut.

Gearbox. Cut the sides, top, bottom and



ends for the gearbox from dural plate. Using a circle cutter set to a fraction less than the ball-bearing diameter, bore the openings in the sides. Check the spacing of the shaft holes by laying the gears in mesh on one of the sides, then drill holes for the bronze bushings. Assemble the gearbox and pack with grease. Mount it on the side of the body, moving it up or down in the two mounting holes to adjust depth of cut.

Cutterhead. A Porter-Cable power-plane cutterhead (part No. PR 83 Y) is used in this plane. Its helical blades cut with a shearing action that leaves a very smooth finish. Drive a short nail through the shaft to pin the cutter to it before tightening the locking nut.

Bevel guide. Attach this to the body with two hinges, using flathead machine screws driven into tapped holes to secure them. Bolt the adjusting-arm bracket to the gearbox and bend the arm from a ¼" bolt to form a quadrant that slides in the bracket. A setscrew in the bracket locks the arm to set the guide at the desired angle for planing beveled edges.

Chip shield and handle. Cut the chip shield from sheet aluminum and bend it to fit over the cutterhead. Shape the handle from hardwood and insert a nut sideways into the transverse hole. Thread a flathead machine screw up through the bottom of the plane into the nut to lock it firmly in place.

Flexible-Shaft Plane

A SOLID block of hardwood sandwiched between two aluminum plates gives this plane a hefty feel. Cut the block to size and bolt the side plates to it. Then remove the sides and cut the center of the block away from the cutterhead. Made in this way, the body will line up perfectly when the bolts are again inserted in their holes. Easiest way to get the side plates identical is to clamp them together while boring and drilling the holes. Bodies of the flat plane and curved plane are made the same, except for the difference in their bottoms.

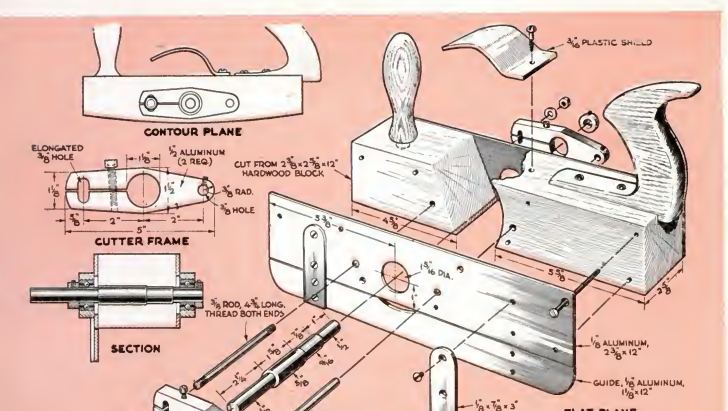
Cutterhead frame. Shape both sides of the frame as one by clamping them together. Bore the large holes to an easy fit around the ball bearings, then cut the slots that clamp them in place by the squeezing action of the Allen-head screws. Drill holes at each end for the pivot and adjustment shaft. Elongate the forward hole so that the frame can be raised or lowered to change the depth of cut. Carefully made, the frame should fit both planes.

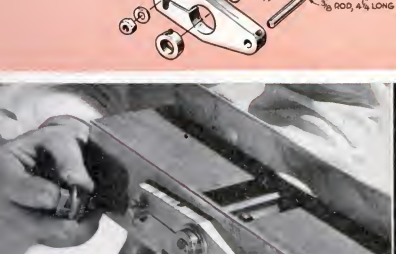
Cutterhead shaft. The Shopsmith jointer head used here requires a specially turned shaft to fit its stepped bore. You can have this turned from the drawings at reasonable cost at a small machine shop. It has a ½"-diameter shank for use with a ½"-flexible-shaft chuck or heavy-duty electric drill. Two collars hold it in position in the bearings.

Handles and chip shield. Two handles are needed to resist the back pressure of the ¼"-deep cut that can be made. The front handle is glued into a hole drilled for it. The rear handle is screwed to the top of the hardwood body. Use clear plastic, heated and bent to shape, for the chip shield.

FLAT OR CURVED EDGES can be smoothed with this pair of planes that share a common cutterhead. Allen-head screw (arrow) draws slotted frame tight on bearings. Two collars position shaft in bearings.

Guide strip. Cut this from the same aluminum used for the sides and fasten it with two short strips screwed into the body. It is not adjustable, but can be removed for planing flat surfaces. No guide is used on the contour plane.



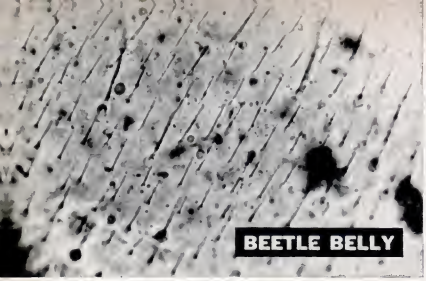


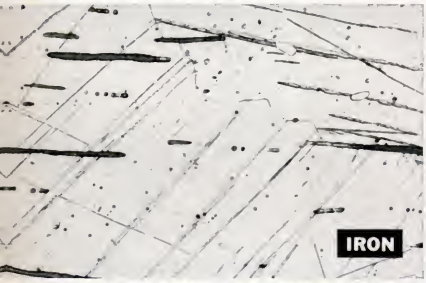
DEPTH OF CUT is adjusted by loosening nut (held in hand) and moving elongated holes in frame up or down on bolt. Frame pivots on length of drill rod locked in end holes with setscrews.

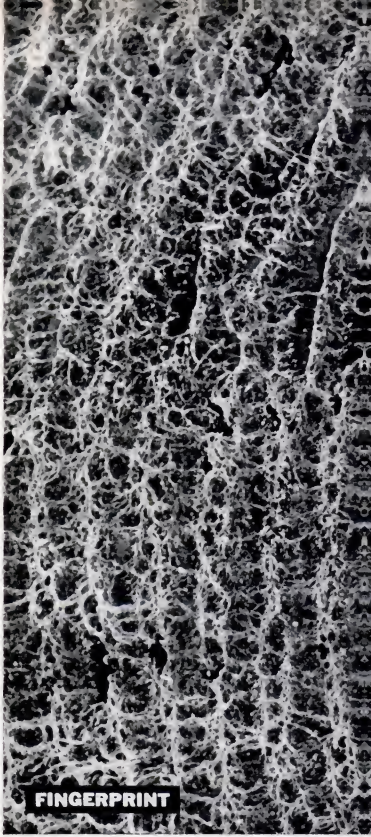
FITTED CHEST stores cutterhead assembly in cover, ready for use in either plane at a moment's notice. Screwdriver, wrench and Allen wrenches are included for setting up the planes and adjusting depth of cut.

TIPS ON USING POWER PLANES

- Maintain firm downward pressure on the forward end of the plane to keep it from rocking down into the already-planed surface.
- Wherever possible, plane along grain that is running upward to the surface. Planing downhill grain will tear out splinters.
- If plane chatters, inspect depth of cut adjustment and tightness of lock nut holding cutterhead on shaft.
- Rest plane on two blocks of wood when not in use to keep cutter off bench top.
- Pull wall plug or remove plane from drill chuck when adjusting cutter.
- Clamp or brace work securely when planing.

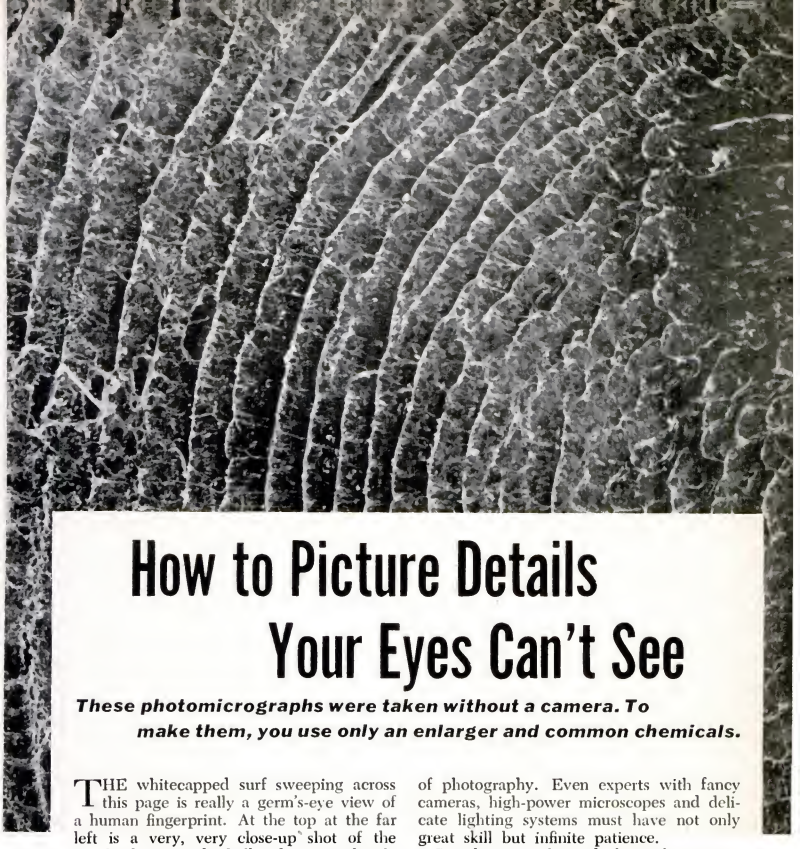






HOW IT'S DONE

MAKING PHOTOMICROGRAPH starts by brushing acetate-acetone mix onto clear acetate film. Then softened film is pressed hard against subject (center, below). Peeled off a minute later, it carries impression of surface. Film is now inserted in protective mask folded from stiff gummed paper with a 3/8" hole in center. This acts as film carrier in the enlarger, provides space for data. When excess is trimmed, film is ready for enlarger.



How to Picture Details Your Eyes Can't See

These photomicrographs were taken without a camera. To make them, you use only an enlarger and common chemicals.

THE whitecapped surf sweeping across this page is really a germ's-eye view of a human fingerprint. At the top at the far left is a very, very close-up shot of the regular hairs on the belly of a water beetle named Hydrophilus. Below it is a sheet of iron, magnified a thousand times so that you can see the black needles and dots of a nitrogen compound, and parallel lines where layers of atoms have slipped under shock. At the bottom is the way a cotton handkerchief looks to a moth.

All of these pictures are photomicrographs—highly enlarged photos of microscopically small detail. Such photographs can give you fascinating insights into an invisible world. But taking them by the usual methods is one of the hardest kinds of photography. Even experts with fancy cameras, high-power microscopes and delicate lighting systems must have not only great skill but infinite patience.

But the man who took these photomicrographs didn't even use a camera, let alone a microscope and fancy lights. His equipment was simply a good photographic enlarger and such common materials as safety film, acetone solvent, gelatin and glycerin. You can use his method—and stump the experts.

How you do it. Your "negative" is a transparent impression of the surface you want to photomicrograph. The surface irregularities on the transparency may be almost invisible, but in the enlarger they will bend the light rays to produce an

image. Since your transparent impression, unlike a conventional negative, has no grain, it can be blown up to the full capacity of the enlarger. Greater enlargements, such as the thousandfold magnification of iron shown, can be obtained by making a film negative of the biggest projected image and then enlarging this.

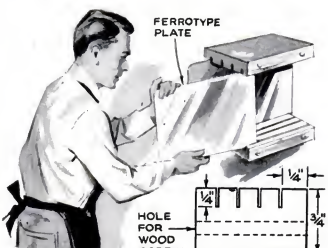
You prepare your transparency by softening the face of clear safety film—acetate—with acetone solvent. Slow up the evaporation of the acetone by adding one part acetate, made from clear film snips, to 50 parts solvent, measured by weight. Brush this mix onto one side of the safety film. (Clear film can be obtained by developing an unexposed strip.) Press the film, soft side down, firmly onto the surface to be pictured. Peel the film off when dry and it will carry the impression.

When you project this impression in your enlarger, you will find that stopping the lens down will make all parts of the image sharp. This is something you can't do with a conventional photomicrograph, where the depth of field is negligible. Use a normal or hard glossy bromide paper for the final print.

There's a second way, too. You can't use this process on some surfaces that are so soft or so delicate they would be damaged by forcing the acetate film down on them. These can be photomicrographed by making a transparent casting with a mix of equal parts of powdered gelatin and glycerin. Heat the mix on a water bath at about 140° until homogeneous. A little water aids solution but too much is fatal. The exact proportions will vary slightly according to the properties of the gelatin you're using. Experiment until your mix solidifies at 105° to 120° F. and sets instantly when suddenly cooled to below 85° F.

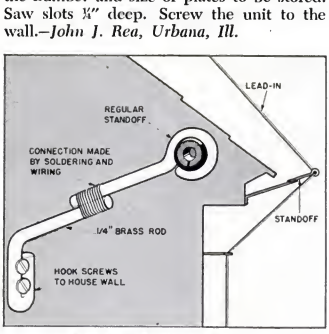
Smear your mix on a slide and put the object on it. Then hold gelatin, slide, and object under cold running water to set your casting. Stripped off half an hour later, it can be used as a negative the same way as the acetate impression.

These gelatin castings will last only a week or so, before they become distorted. If they are left too long in the enlarger, the heat will ruin them. But with this technique you can even photograph delicate insect hairs that blur when shot through a microscope.—*H. Courtney Bryson, Lisbon, Portugal.*



Rack Holds Ferrotype Plates

FERROTYPE plates used in drying glossy photos are neatly stored in this convenient rack fastened to a darkroom wall. Vary the length and width of the blocks to suit the number and size of plates to be stored. Saw slots ¼" deep. Screw the unit to the wall.—*John J. Rea, Urbana, Ill.*



Rod Stands Off TV Lead-In

THE longest standoff I could obtain couldn't keep my TV lead-in from resting on the roof overhang. So I soldered a ¼" brass rod to one end of a regular standoff. I bent the other end of the rod into a hook and fastened it firmly to the house with a couple of screws—*David B. Grant, Nashua, N. H.*

Movie Film Stored in Tape Can

I FIND that a cellulose-tape can is just right for storing my 8-mm. movie film. Fifty feet of film fits nicely into a large can for ¾" tape. A moistened blotter placed in the bottom of the can keeps the film from drying.—*Lynn Zettlemoyer, Allentown, Pa.*

PLANK FLOORS, found in many new homes, are usually laid in random widths like floors of colonial days. Most planks are blind-nailed along the edges, but are also fastened with screws at ends. Screw holes are plugged with wood of contrasting color as above.

How to Choose from

New Types of Wood Flooring

Strip flooring is still by far the favorite, but today you'll also find new varieties that you may prefer underfoot.

By Darrell Huff

WHAT kind of wood floor would you like? Name it, and most likely you can have it. But with so many kinds of wood to choose from, offered in so many dimensions and patterns, it can be pretty confusing. Here's a guide to wise selection:

- Your basic choice is among three general types—strip, plank or block.
- Next you'll choose the wood—not only what variety, but also the kind of grain, grade and thickness.
- Unfinished or prefinished flooring will be a choice offered you in some types. The unfinished kinds call for more work, of course; the prefinished, for more money.

Strip flooring is what people usually mean when they say simply "hardwood floors." It's losing ground to block and plank types but it's still far and away the champ in popularity. The most commonly

used kind of strip flooring consists of oak boards tongued and grooved on edges and ends, 25/32″ thick and 2¼″ wide. Or it may be 1½″, 2″ or 3¼″ wide. A variation calls for alternate strips of 2¼″ and 3¼″ widths. All dimensions are actual and do not include the tongue width.

If you are laying a new floor over a sound old one, you'll very likely prefer to use thinner flooring—⅜″ or ½″. These won't raise the floor level so much and they cost less.

T-and-g strip flooring is made in these dimensions in white and red oak and in beech, birch, hard maple and pecan, less often in other woods. You'll also find hemlock, an excellent softwood flooring, in 25/32″ x 2¼″.

This kind of strip flooring is laid by blind or "secret" nailing—diagonally through the tongues. It is face-nailed only along edges where molding will cover. Don't try to economize on nails—they're the answer to squeaky floors.

Less often found is square-edge strip flooring, which you simply butt together and face-nail. Nailheads are set and holes filled before finishing. Oak square-edge strips are commonly made in 5/16″ thickness, 1½″ or 2″ wide. In maple, birch, beech and pecan they are usually 25/32″ thick, 2¼″ and 3¼″ wide. You can use 1⅛″ barbed wire flooring brads with No. 16 heads. Put two nails every 7″.

Plank flooring is the kind you're seeing more and more in new homes, particularly those of ranch style. It is usually laid random width. As with strip, the most usual type is tongued and grooved on edges and ends, although some varieties are not end-matched and others are square-edged all around. Usual thickness is 25/32″ or 13/16″ or, in a veneered type, ⅜″. Widths run all the way from 3″ to 9″.

Most plank flooring is blind-nailed like strip, but it needs more than that to hold it securely because so many of the boards are so wide. The usual method is to put one or two 1½″ No. 12 flathead wood screws near the ends of the boards and additional screws or face nails at intervals of about 30″. Screw holes are counterbored and heads covered by pegs made for this purpose.

A popular variation is called Ranch Plank,* prefinished strip flooring laid in alternate 2¼″ and 3¼″ strips with blind nailing alone. Since it contains walnut plugs already set in, it looks much like traditional plank.

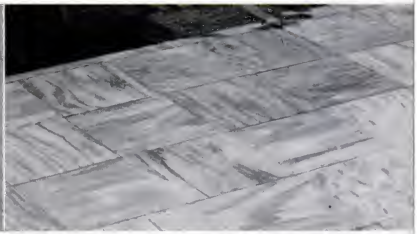
Quite different is a plank-effect flooring called Broadboard. It is laid in mastic without any nailing, much like asphalt tile. It can be fastened to almost any sound subsurface—wood, plywood, terrazzo, old asphalt tile. It can even be laid directly over concrete slabs without sleepers.

Broadboard is made of 3/16″ oak, prefinished blond or medium, is 9″ wide and comes in 4′ to 8′ lengths. Almost invisible slits every half inch, top and bottom, reduce expansion problems and let the flooring conform to slight subfloor irregularities.

Block or parquet is the other big comer. Fine parquetry is mighty expensive and has always been associated with public

**Further information about Ranch Plank can be obtained from E. L. Bruce Co., Memphis, Tenn. Broadboard is a product of Porkay, Inc., Louisville, Ky. West Coast Vertical Grain 4-Square, also mentioned in this article, is made by Weyerhaeuser Sales Co., St. Paul, Minn.*

STRIP FLOORS of narrow boards are the most popular type. One shown above is oak and may be bought either unfinished or prefinished. Strip comes in a wide variety of woods, grains and grades. The prefinished type is ready to use as soon as it is nailed.



LAMINATED BLOCKS shown above are made of three plies of oak. A half inch thick, they are made especially for use over concrete, the three plies increasing stability and usually making waterproofing of base unnecessary. They can be used over radiant heating slabs.

In using mastic, shown above, select variety recommended by manufacturer of your flooring.

buildings or mansions. Modern block types, however, are within the cost range of other flooring and are found with increasing frequency in modest houses.

The basic type is 9″ square and ½″ or 25/32″ thick. It usually is tongued and grooved and may be laid in mastic over concrete, or nailed to a wood subfloor or old floor. Other types are laminated for stability, or slit to make them extra flexible.

A new development brought on by the increasing use of radiant floor heat is 8″ square tiles of 5/16″ gothic oak, each tile being made up of four strips. The strips cut down the expansion problem and the gothic oak itself—long considered a fine cabinet wood—expands only one-fourth as much as plain oak under changes in humidity. Gothic oak is also offered in foot-square tiles consisting of four 6″ squares flexibly cemented together.

Still another handsome parquet type is a basketweave pattern of foot-square blocks composed of 2″-by-4″ and 2″-by-2″ pieces. These ¾″-thick units are made in gothic, blond and medium oak, walnut, mahogany

SOLID BLOCK floors, like one above, are increasingly popular. They come either unfinished or prefinished, can be laid in mastic over concrete or nailed to wood subfloor.

PREFINISHED OAK BLOCKS above have fine slits for extra flexibility in laying over rough base. The blocks are only 3/16″ thick and can be laid over any surface.

STRIP BLOCKS are made of mixed hardwoods. They come prefinished and are cheaper than most types. The blocks can be put down on top of either concrete or wood.

and teak. Like all the other special types described above, this comes prefinished.

What kind of wood? Most hardwood floors are oak, made of the nine varieties classed as white oak or the 11 called red oak. Red oak has a pinkish cast rather than brownish and finishes to more of a reddish brown. White oak is somewhat more uniform in color, may be slightly easier to finish. One gives as good a floor as the other. In both you have a further choice between plain and quarter-sawed. The latter gives a prominent figure you may or may not find preferable.

Next in popularity is hard maple. It is harder than oak and will take heavier wear, a quality more valuable in gymnasiums than homes. The grain and figure are much less conspicuous than in oak and there are no pores to fill in finishing. Birch and beech make a very hard floor, much like maple. Pecan is harder and darker in color than other common floor woods.

Hemlock, though technically a softwood, makes a floor that can be both handsome and durable at relatively low cost. The maker of a variety called West Coast Vertical-Grain 4-Square calls it the "hard softwood" and offers it in the tongued-and-grooved and end-matched pattern.

All the woods mentioned here are widely used in strip flooring. You may not be able to find block and plank types in anything except oak.

Prefinished? Whether you choose strip, plank or block flooring, you can find both unfinished and prefinished types. In some you'll have a choice between light and medium shades.

If you have sanding equipment available you can save a good deal of money by doing your own finishing. You'll earn the money, of course.

Prefinished flooring permits you to use the floor as soon as it is laid and insures a good and lasting finish. In a remodeling job it avoids the mess made in an occupied house by sander dust.

If you decide to buy an unfinished flooring, it is worth keeping in mind that most manufacturers now recommend penetrating sealers in preference to the older stain-and-varnish treatment or shellac or lacquer. Penetrating sealers usually look good longer, can easily be refinished in worn spots, don't chip or scratch. They give a good deal less shine to the floor but not everyone will consider this a drawback.

What grade? Any grade of wood will give a good, sound floor. Higher grades simply are freer of knots, streaks, sapwood, variations in color and small manufacturing defects that have little to do with strength

[*Continued on page 272*]

HINT TO AN UNHANDY HANDY MAN

If you're stuck for new ideas
And old lines of thought won't yield,
Wake up your mind by reading
Publications in your field.

—Hugh Lineback

WOOD FLOORING

This table applies to the most common sizes of tongued-and-grooved hardwood strip flooring. First column gives the actual dimensions of the flooring, including width covered by each piece. Second column gives size the flooring is counted as in figuring board feet. To find the number of board feet to buy from the square footage of the room, add the percentage shown in the third column. It includes 8% for waste in cutting.

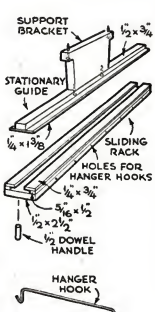
Actual dimensions	Counted as	Add to sq. ft. of room to find bd. ft. needed	Usual nail size	Maximum nail spacing
25/32"x3¼"	1"x4"	27%	8d	10"-16"
25/32"x2¼"	1"x3"	36%	8d	10"-16"
25/32"x1½"	1"x2¼"	53%	8d	12"-16"
½"x2½"	1"x3"	23%	6d	10"-12"
½"x2"	1"x2½"	28%	6d	10"-12"
⅜"x2"	1"x2½"	28%	4d	8"-10"
⅜"x1½"	1"x2"	36%	4d	8"-10"

FOR YOUR POPULAR SCIENCE MONTHLY INFORMATION FILE

Sliding Rack Brings Out Pots

A SLIDING rack like this will end the clatter that usually occurs when a pan is taken from a kitchen cabinet. The stationary guide and supporting bracket is a single unit. Make it from three pieces of clear pine as the drawing shows. Screw the parts together after spreading the joining surfaces with glue. Center the bracket under the cabinet top and screw it in place.

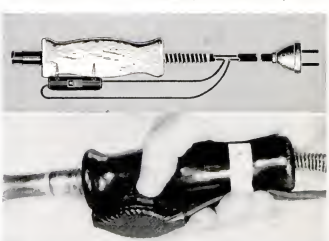
Make the sliding rack from five strips of clear pine to form a T groove. Join these with glue and screws. Use 11" lengths of No. 9 steel wire for the hanger hooks if some of your pots are heavy. Otherwise, coat-hanger wire will do. Bend one end to shape and slip the wire through holes in the sliding unit, then bend the other end. Sand all parts smooth and finish with paste wax for good looks and easy operation. *—Dean Keach, Fairview, Ill.*



Dowel Glues Bandsaw Tires

AS INSTRUCTOR, I was faced with the job of putting new rubber tires on our school-shop bandsaw. These had to be cemented, and the directions that came with them suggested using "several helpers" or stretching a tire over a circle of nails and sliding it from these onto the wheel.

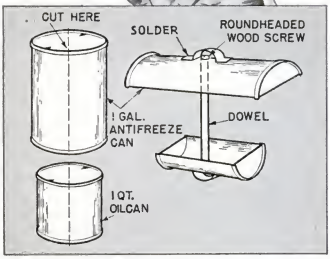
I found a tire could easily be put on a wheel singlehanded if no cement was applied. Having done this, I inserted a dowel under the tire and applied cement behind it while gradually working the dowel around the wheel.*—J. A. Schulze, Commerce, Tex.*



Switch Handy on Soldering Iron

INSTEAD of reaching for the plug every time you use a soldering iron, mount a feed-through switch on the handle to turn it on or off as needed. Separate the halves of the plastic case and screw one half to the handle of the iron. Hook up the wires and fasten the second half. Splice the two wires running from the switch into one leg of the line cord and tape them to the handle. *—John J. Rea, Urbana, Ill.*

Bird Feeder Cut from Tin Cans



Two tin cans, one a quart oil container, the other a gallon antifreeze drum, are cut Quonset-hut-wise to form the roof and seed holder of this novel bird feeder. A length of broomstick or 1″ dowel, attached to their centers with round-headed wood screws, connects the can segments. Strips cut from discarded tin stock are looped and soldered above each screw to form eyes from which the feeder is suspended and anchored to prevent swaying. A coat or two of bright paint makes the feeder ready for business.—*Howard E. Moody, Upper Jay, N.Y.*

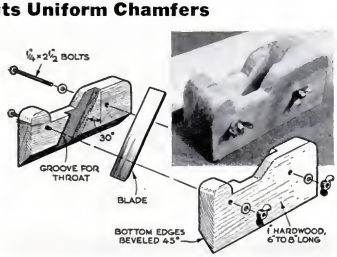
Rubber Plug Holds Emery Disk

You can clean or polish flat metal surfaces fast by a method used in the Convair aircraft plant. Drill a 3/16″ hole in a rubber plug or stopper, put a nut and washer on a ¼″ bolt, and turn the bolt into the plug. Tighten the nut against the washer. Chuck the bolt in an electric drill, lay a disk of emery paper on the metal and press the plug against it. Friction will hold the disk in place as it spins.

Homemade V-Bottomed Plane Cuts Uniform Chamfers

Chamfering is no trick at all with this homemade plane. It holds the angle and regulates the depth of cut as it straddles the corners of wood projects.

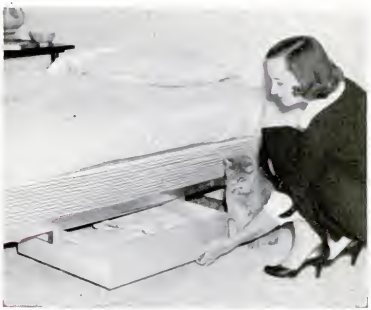
Shape the two cheeks, or sides, from hardwood. Cut a groove on a 30° angle on the inside face of each and bevel the bottom edges 45°. The grooves form the throat for the blade (piece of power hacksaw or tool steel). When joined they should be slightly less than the width of the blade so that pressure will lock it in. Depth of cut is set by tapping the blade down.



Storage Drawers Slide Under Bed

Build a pair of these units and you can present your wife with some usable space she never knew she had.

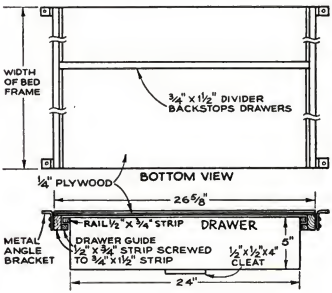
By John Rogers



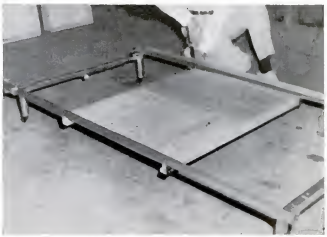
If your wife is like most others, she wants more storage space. Here's a way to give her some that's been right under her nose—the unused space under a bed. Two drawers set back to back provide on-the-spot storage for bed linen and blankets. If one side of a bed is pushed against the wall you can put two drawers side by side.

First step is to measure the width of the bed and cut a piece of ¼" plywood to fit across. Cut the plywood 26⅝" wide—or to suit the width of the drawers you plan to build. This panel supports the drawers on L-shaped guides. Make each guide by screwing a ½"-by-¾" hardwood strip to a ¾"-by-1½" strip that has been screwed on edge to the plywood support panel. Spread glue on the meeting edges before screwing. Screw a divider strip across the center of the support panel to backstop the drawers. Bolt or screw this assembly to the underside of the bed frame, using metal angles.

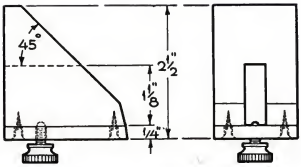
Make the drawers from ¾" white pine with ¼" plywood bottoms, following conventional drawer construction. The length of the drawer sides will be the distance from the edge of the support panel to the center dividing strip. Glue and screw ½"-by-¾" cleats on the sides of each drawer to slide in the bottom guides.



METAL ANGLES are screwed to drawer guides, then bolted or screwed to underside of bed frame. The drawer guides are assembled on ¼" plywood panel that fits across bed.



PLYWOOD PANEL acts as dust cover over the drawers, besides supporting the drawer guides. Two drawers fit into the unit, one from each side of the bed. Drill holes through bed frame to bolt metal angles fast.

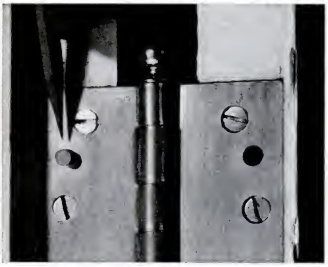


Yardstick "Slide Rule" Measures Miters for Frames

SET this gauge to the size of the picture you're framing and use it to measure the miters. Regardless of the depth of the rabbet, the molding will fit.

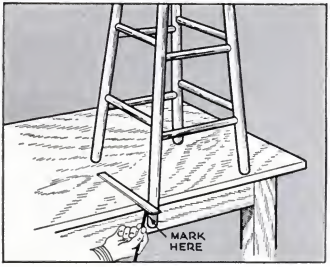
Cut the sliding block from 1½"-thick hardwood and groove the center to straddle the yardstick. Screw an aluminum or hardboard base plate to it and tap it for a No. 10-24 thumbscrew. Paint a 45° angle on the end of the yardstick, starting it at zero.

To use the gauge, cut a miter on the right end of the molding. Set the gauge for the length of the picture and lay it *in* the rabbet with the angle of the block flush against the mitered end. The point where the edge of the painted angle appears from under the rabbet is the true length of the molding. Make a pencil mark at this point for cutting the second miter.—*Arthur Volz, Dayton, Ohio.*



Stud Interlocks Butt Hinges

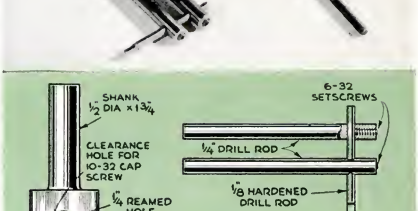
EVEN though the pins are removed from butt hinges, this trick keeps the door from being opened. Drill through both leaves while they are folded together. Tap one hole for a stud. This fits into the other hole when the door is closed.



How to Shorten Stool Legs

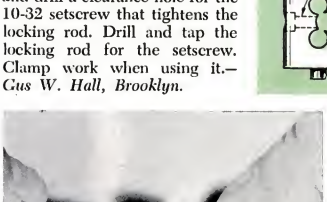
A STOOL or chair won't wobble when you shorten the legs if you do it this way. First cut three legs by measuring down from the seat. Then set the stool on a flat table top and use a ruler laid on its surface to mark the fourth leg.

NEW Shop Ideas



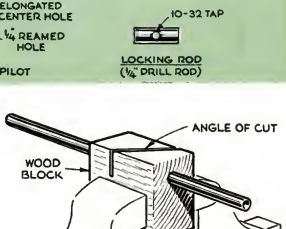
Circle Cutter for Drill Press. A single setscrew locks both arms of this circle cutter at any desired radius by pulling a short length of drill rod against them, wedging them securely.

Turn the body from 1" drill rod and mill or file a flat on one side. Drill three 1/4" holes through the flat side and elongate the center hole with a round file. Drill and tap one end of each arm for the setscrews that hold the cutter in place. Shape the cutter from a piece of 1/8" drill rod. Assemble the parts and drill a clearance hole for the 10-32 setscrew that tightens the locking rod. Drill and tap the locking rod for the setscrew. Clamp work when using it.—*Gus W. Hall, Brooklyn.*



Screwdriver Turns Small Sockets. A heavy-duty screwdriver that has seen better days can still serve as a useful addition to your set of small 1/4" drive sockets.

Grind or break off the screwdriver blade and grind the end of the shank square to fit snugly in the 1/4"-square drive holes in the sockets. It makes a handy tool for reaching nuts and boltheads in hard-to-get-at places.—*Pvt. Philip E. McCafferty, Fort Bliss, Tex.*

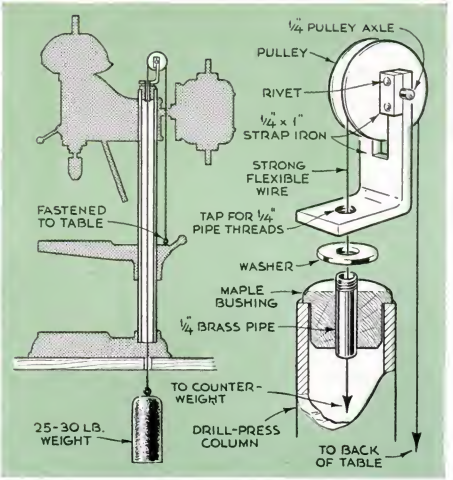


Block Guides Angle Cuts in Tubing. Try inserting tubing in a hole bored in a wood block so that you can guide the cut by a line drawn on the top flat surface of the block. Run the saw through the saw kerf in the wood if more similar cuts must be made in the same diameter tubing.—*Chas. H. Willey, Penacook, N. H.*

Please turn the page for more shop tips.

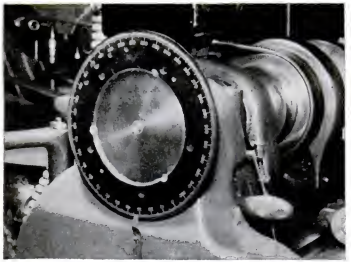
Counterweight Balances Drill Table. Why struggle to slide a heavy drill table up and down on its column, when a counterweight will lighten the job?

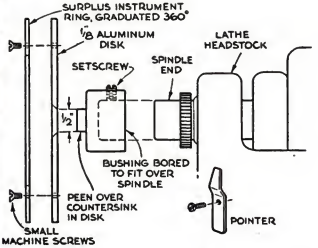
Link the counterweight to the table with a length of flexible stranded wire (heavy picture-hanging wire will do). Run the wire from the back of the table up over a pulley mounted on a maple bushing turned to fit into the top of the column, then down inside the column and through a hole in the bench to the weight. The weight should come within a few pounds of balancing the table. Support the pulley on an angle bent from heavy strap iron. An extra piece of strap riveted to the top of the angle adds thickness for the ¼"-bolt axle. —*Wm. S. Manchester, Ottawa, Ont.*



Indexing Dial Fits on Lathe Spindle. A graduated ring commonly found in surplus-instrument stores is the key part of the indexing dial below. It accurately divides any diameter into a maximum of 360 divisions.

Fit a disk cut from ⅛" aluminum to a bushing bored to fit over the back end of the spindle and fasten the ring to it with flathead machine screws, countersunk. Drill into the bushing for a setscrew to lock it on the spindle. Cut a small pointer from sheet metal and mount it on the lathe gear cover with one screw so it can be swiveled out of the way to remove the dial. —*Floyd McGuckin, Ridgewood, N. J.*





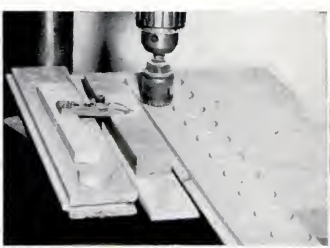
Cylinder Head Makes Handy Shop Anvil. A junked and otherwise useless auto-cylinder head can still see plenty of service in a workshop. The flat surfaces make a solid anvil for hammering or shaping metal. Spark-plug and stud holes serve for knocking out rivets, pins or bolts and the dished combustion chambers can be useful for beating sheet metal into concave shapes. Mount it on a stand near your bench vise.

Plugs Cut from Board Face Mend Floor Defects

A DODGE I use to repair roller-skating rinks may prove handy to the homeowner. Some rink floors are maintained by boring out defects and driving in a piece of hardwood dowel. But such a repair tends to be conspicuous because the grains do not match and the end grain of the dowel swells more than the surrounding cross grain.

Plugs cut from the face of matching hardwood flooring are better on both counts. The photos show how to make quantities of them fast. The bad spot is bored out to slightly less than plug diameter and short of plug thickness. Glue is applied and the plug driven in, planed flush, sanded smooth.—*V. R. Day, Albany, Ore.*

FLOOR DEFECTS are bored out with a bit to make a tight-fitting hole for the plug. Drive fit requires no nails. If a plug of similar grain is chosen and properly set in place the repair will be hard to spot.

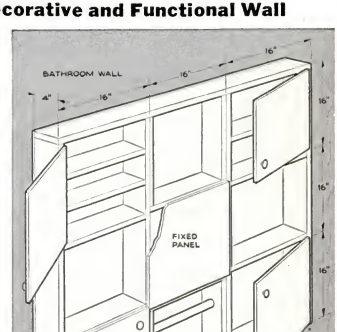


HOLE SAW 1¼″ in diameter produces 1⅛″ plugs. Fence is clamped to drill-press table, depth stop set to let saw cut ½″ deep, and circles spaced ¼″ apart. This gives two rows of plugs from a 2¼″-wide piece of flooring.

TO CUT PLUGS FREE, the stock is run over the circular saw with the fence set to cut through at bottom of the hole-saw cut. With 31/32″ flooring stock, cut may be right through center of thickness. Plugs fall out at side.

Shelving Plus Cabinets Makes Decorative and Functional Wall

THE contents of an overcrowded medicine cabinet will never again tumble down on you if you finish one wall of your bathroom with this cabinet-and-shelf arrangement. The shelving is ¾″ stock with doors of ¼″ hardboard. Pictures and small ornaments can be used to decorate the shelves. A length of ¾″ dowel set in the center compartment keeps towels within easy reach.—*Hi Sibley, Nuevo, Calif.*



▶▶▶Stripping plastic insulation off solid wire will give you small-diameter tubing in a variety of colors for experimental purposes. Clamp one end of the wire in a vise and work the insulation off by hand.—*Carl Tretin, Austin, Minn.*

TV Lead-In Hides in Wall

If you live in a one-story house, you can easily run your TV lead-in down through the wall behind the set. You'll probably shorten the lead-in too, improving reception. Drop a nail on a string from the attic through a hole in the wall framing. Catch the nail in a wire loop inserted in a hole in the baseboard (like threading a big-eyed needle). Tie the lead-in to the string and drag it down inside the wall and out through the baseboard. Trim wire to fit.—*M. Corn, Shrewsbury, N. J.*

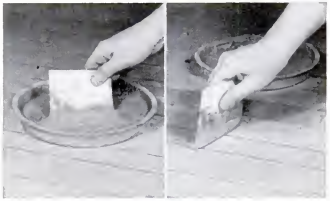
Coffee-Can Lid Wipes Brush

A coffee can with half the lid cut away and rolled under provides a container with a smooth drip-proof edge for wiping excess paint from your brush.—*R. L. Ellis, Miami Beach, Fla.*

High Pulleys Oiled by Rope

When pulleys on sky-reaching flagpoles begin squealing for lubrication, soak a foot of the halyard in oil and quickly raise it up on the pulley. Seesaw it briskly with the rope's oiled section in the pulley to throw the oil around and quiet the clamor.—*Edward Mayover, Philadelphia.*

Plastic Spreader Makes Floor-Filling Easy



1 **Spare your muscles** and do a better job next time you spread filler into a new or worn floor. The trick is in using a broad plastic joint knife or a square of stiff plastic instead of a brush or steel blade.

2 **Dip plastic blade** in filler thinned to almost brushing consistency with 50-50 mix of half-boiled linseed oil and turpentine. Apply mix to floor with single strokes in direction of grain. This fills pores.

3 **Pushing blade** back across the fresh filler scoops up any excess paste. This can be scraped off on the side of the container for further thinning and re-use. The return stroke also packs the wood grain.

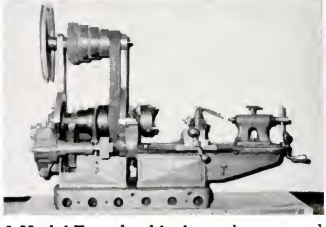
4 **Light rubbing** with a rough cloth 20 minutes after the filler is applied will remove all traces of surplus paste. Allow the filler to dry from 36 to 48 hours before finishing. — *Andrew Brennan, Philadelphia.*

Lipstick Tubes Make Bit Cases

Those little metal tubes that your wife throws away when she's finished a lipstick make good cases for small drills and router bits. A piece of rubber sponge soaked with light oil and wedged in the bottom will ward off rust. Individual lathe tools can be protected in the same way.—*John W. Sherman, Mt. View, Calif.*

CRAFTSMEN AT WORK

An electric windshield-wiper motor drives the rear wheels of this model—a two-foot version of a 1911 Maxwell. A line cord brings power from the battery of an automobile parked nearby. The model has a sliding-gear transmission with two forward and two reverse speeds, pre-selected by manual levers on the running board. A second motor controls the steering. Using remote-control switches, builder George Tobi Jr. of Jacksonville, Fla., can maneuver the model in a 16-foot circle.



A Model T engine block now has a second life as a lathe—16″ between centers and with 4″ chuck capacity. The handle at the front of the lower pulley can be moved sideways to throw out the back gears, made from Model T timing gears. A small emery wheel has been mounted on a bracket where the generator used to be. The spindle can be locked for direct drive. Francis Cooper, who lives in Portland, N. D., made the conversion.

Dental drills and a flight computer helped in building this pair of model power boats. Don Henry of Louisville, Ky., used the delicate drills to make detailed fittings —including air horns and spotlights and illuminated instrument panels with movable needles on the dials. The flight computer enabled him to figure dimensions from blueprints of the full-size originals. Electric motors drive the models up to five miles an hour.

[Continued from page 180]

There's nothing wrong with those mains. We put in new ones, top and bottom halves."

"Just curious, Sam," Gus said.

Gus loosened the four husky main bearings, being careful not to let the main shaft down so far that the gears of the timing gear would disengage from the main sprocket. He took the front main cap off entirely, punched out the top half of the bearing with a soft brass driver. He looked into the crankcase.

"Curiosity," Sanderson remarked dryly, "often kills more than cats."

Gus ignored the wisecrack, and went calmly ahead with the job. He tightened up on the mains, then reached out for a handful of cotter keys, inserted them in the mains. He slid out with the oil pan.

"The gasket," he said to Sanderson, "looks all right, wouldn't you say?"

"It's all right," Sanderson told him impatiently. "Put the pan on, and if you're through I'll get rolling. Being shorthanded has put us way behind."

Gus put the pan on and the oil in.

"You don't need to be shorthanded," he said. "Joel Howard needs a job."

Sanderson Plays It Safe

"Joel Howard!" Sanderson growled. "I wouldn't rehire that . . ."

Sanderson cut himself short. He peered at Gus with wary eyes. But Gus walked away and sat on the bench.

"I reckon," he said placidly, "that you'll go far to get a better man."

"You're crazy, Gus!" Sanderson yelled. "Three rods in less than a week. I'd be a durn fool . . ."

"I'm not buying you any coffee, Sam," Gus told him. "Not today."

Sanderson's face was a picture of perplexity. He wanted to know just what Gus had found, but he didn't dare ask. He got the sudden and sure feeling that the best thing he could do was to drive out of the Model Garage and go ask Joel Howard to come back to work. He'd best drive out and forget that he ever came in, as he knew that if Gus had found anything amiss while under the truck, the town would never know about it—not if Joel Howard was back to work.

"Maybe you're right," Sanderson said, as he climbed in and drove out.

"You aren't the only one around here that's curious, Gus," said Stan Hicks, who had kept an eye on the proceedings, in between trips to the pumps. "Did you find something, or were you just tossing a bluff?"

Stan Gets the Story Straight

"No bluff," Gus told him. "I ran into the same deal once before. The oil lead from the pump to the main shaft on that truck comes down through the block into the top half of the front main. When I heard that Sanderson had put in new mains, and that rods five and six were going out, I got suspicious.

"The oil hole in the top half of the front main on this model truck is slightly off-center, front to rear, and it's easy to put in the case backward. When this is done, the oil hole in the bearing meets the oil holes in the block and main shaft less than halfway. You got oil pressure, but you got it in the wrong place. The oil flow to the shaft is cut down so much that although the forward rods get by, the back rods starve on a heavy pull.

"All I did was to turn the top half of the front main. The way it was, Sam would have burned out a rod himself."

"Then it wasn't Joel's fault at all!" Stan said.

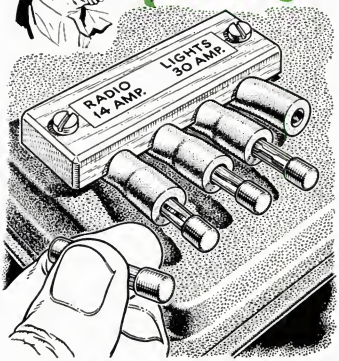
"And the best part of it was that Sam knew it when he left here. He'll puzzle it out for himself after awhile."

"And," Stan said angrily, "Silas Barnstable was around here tearing Joel down. He'd like to see Joel stay fired."

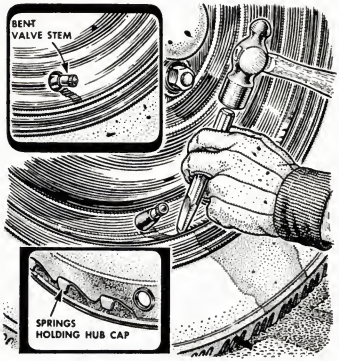
"Oh, I wouldn't say that, Stan," Gus grinned. "Who do you think took my tip, and went up to prod Sanderson into coming down here? Silas really wanted Joel to get a break."

"Just for that," Stan vowed, "I'll go out and put air in his tires every day for a week, and smile." END

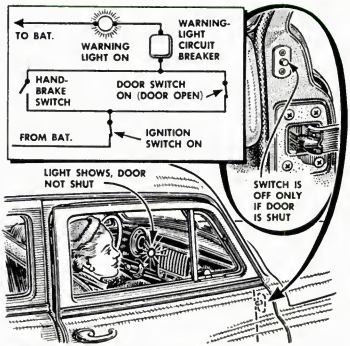
Hints FROM THE MODEL GARAGE



Tuck spare fuses into a clip made from short lengths of windshield-wiper hose for quick replacement as needed. A notched wood block screwed to the inside of the glove-compartment door holds the hose.



Raise a series of burrs around your wheel rims to keep the hub caps or wheel rings from creeping and distorting the valve stems. Chisel the burrs along the marks made by the spring tabs inside the hub caps.

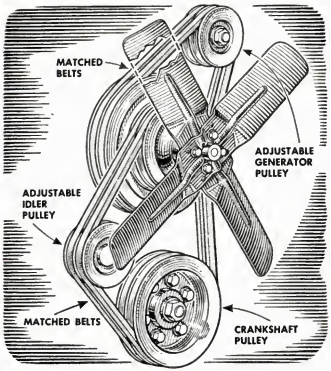


Mount a normally closed switch on the right-hand door to warn you when it's partly unlatched. Wire it through the ignition switch to the hand-brake warning light or a separate bulb on the dash so that you'll know the door is shut before you start.

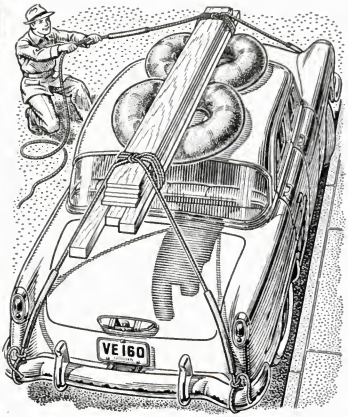
Join two pieces of inner tube with a leather strap to make a pair of sleeves that will protect your arms from dirt or a hot manifold when reaching in or around the lower parts of a motor. Use the sleeves for protection against sparks when welding.

Please turn the page for more auto hints.

MORE Hints from the Model Garage



Replace both belts on a dual-belt drive, even though only one is worn. Slight differences in lengths of belts bearing identical numbers can make one belt do more than its share of work. Matched belts are packed in sets to be used together.

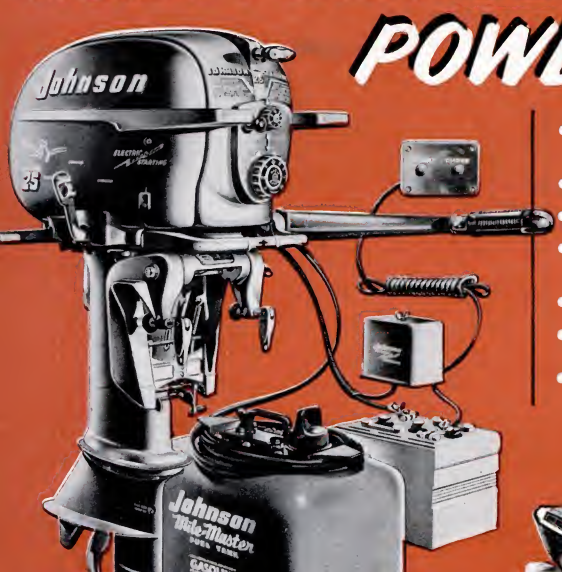


Long boards or other objects too long for the inside of a car can be hauled on the roof, using inflated inner tubes as cushions. Tie the load to the bumper ends to keep it from pivoting, and slip lengths of hose over ropes to protect car finish.

Use a toothbrush to remove the dried and whitened polish from body seams or behind chrome trim. The same brush can be used to *put* wax in these places as a precaution against body rust or to clean dust from the instrument panel and radio grille.

Caught with a flat at night and no trouble light, you can reflect enough light from the headlights to see what you're doing. A road map or newspaper, partly folded down the center and held or propped in front of the car, will do the trick.

Now! PUSH-BUTTON POWER!



- **Electric Starting!** (ALSO EQUIPPED FOR MANUAL STARTING)
- **25 Horsepower!**
- **Speeds Over 30 mph!**
- **Fitted for Ship-Master Remote Control!**
- **Gear Shift!** FORWARD-NEUTRAL-REVERSE
- **Mile-Master Fuel System!** (6 GALLON)
- **Twist-Grip Speed Control!**

ELECTRIC STARTING SEA-HORSE 25

FREE! Write for the new Sea-Horse Catalog. Complete details on the 5 great motors of the 1954 Johnson line—including the revolutionary *quiet* Sea-Horse 5½ and the flashing, newly-styled Sea-Horse 10. Your copy sent free.

JOHNSON MOTORS,
500 Pershing Road, Waukegan, Illinois
In Canada: Mfd. by Johnson Motors, Peterborough

Johnson
SEA-HORSES
FOR DEPENDABILITY

Here is the last word in sheer outboard luxury—*push-button starting!* The new Electric Starting Sea-Horse 25 is a complete unit (except for battery) ready to spin into action at the touch of your finger. With Ship-Master Remote Control for shift and throttle (Johnson accessory), you now have concentrated command of power at your steering wheel. Choke, start, shift, throttle, steer from any seat in your boat!...See your Johnson Dealer. Look for his name under "Outboard Motors" in your classified telephone directory.

THE NEW 1954 SEA-HORSES

SEA-HORSE 5½—5½ hp. Johnson's new "Suspension Drive" sensation. It's *quiet!*.....$210.00*

ELECTRIC STARTING SEA-HORSE 25—25 hp.....$498.00*

SEA-HORSE 25—25 hp. Speeds over 30 mph! With 6-gal. Mile-Master Fuel System. Gear Shift. Twist-Grip. Only....$410.00*

SEA-HORSE 10—10 hp. Power, speed and terrific "getaway." With Mile-Master Fuel System. Gear Shift. Twist-Grip Speed Control. Outboard motoring's *great* buy.....$297.50*

SEA-HORSE 3—3 hp. 32-lb. *twin!* Angle-matic Drive...$145.00*

**F.O.B. factory, subject to change. Weight approx. OBC certified brake hp at 4000 rpm.*

B-C Flash makes sure he gets the picture

B-C stands for battery-condenser. You know what a battery is, of course. *But why the condenser?*

First, let's assume that most of your flash pictures have come out great. But perhaps occasionally a few were *under-exposed* (or didn't come out at all). A weak battery most likely was the cause. It was just weak enough to fire the lamp a fraction late (or not at all, after a few shots had momentarily drained it).

Now—to avoid such possible waste of bulbs and pictures, a *condenser* is substituted for one of the batteries. With this dependable Battery-Condenser system the battery itself doesn't fire the lamp. What the battery does is to feed power to the condenser. The condenser stores the power . . . always a *full charge* of power . . . and it is the condenser that fires the lamp at just the right instant.

The battery can even become weak: yet you'll get your flash picture. Because the power stored in the condenser does the firing, the battery can be used for a much longer time. B-C is extra-dependable, extra-economical flash. It's a system you'll want to own, whether you've taken flash pictures before or are just about to start.

On the opposite page you see the latest Kodak B-C flash equipment. Your dealer will be glad to demonstrate the advantages of B-C. Be sure to see him soon. Make him headquarters for all your photo needs.

NOW . . . an economical Kodak B-C Flasholder—$9.95

You get all these advantages . . . in a dependable B-C unit that fits most cameras with built-in flash shutters:

50% more light—New Lumaclad reflector allows you to stand back further, get more subject in picture.

Sturdy hand grip—Popular press-type, easy to grasp. Adjustable bracket quickly attached (or removed for off-camera shots).

Special lighting easy—Flasholder has connector for multiple lighting with one or two Extension Units (see below).

Cheap operation—Uses low-cost midget lamps in standard sizes: SM, SF, Nos. 5, 5B, 25, and 25B.

Easy-to-use lamp ejector—Simply press release, lamp pops out.

Handy exposure guide—On back of reflector, right before your eyes.

2-Way Flashguard included—Slips over reflector, gives either normal or "soft" light.

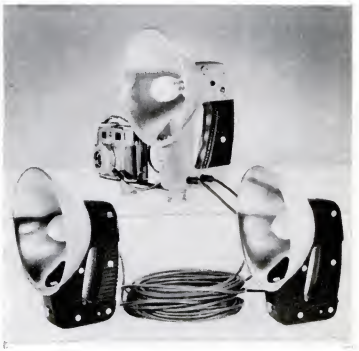
Special adapters available—For attaching Flasholder's ASA-bayonet connection to other type flash connectors.

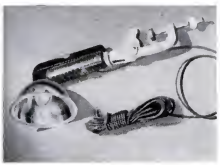
Flasholder also available in Standard model without B-C. Uses "C" batteries; accepts B-C Flashpack (see below). $7.95.

For super-versatility with Kodak B-C Flash

The Kodak Ektalux Flasholder fits most press-type and roll-film cameras. Here it's shown at right with 2 extension units—used for special lighting effects (takes up to 6 units).

The Ektalux gives you many exclusive features: quick loading and ejecting for both midget and medium-base lamps . . . two-way focus of midget lamps for uniform or concentrated light . . . convenient exposure guide . . . comfortable pistol grip. You can trip camera shutter from the Flasholder—or convert non-flash shutters. The Ektalux (with magnesium die-cast body) is durable but light; easy to pack (reflector removable). Flasholder with standard bracket, $29.75.





Take large-area pictures—Kodak Flasholder Extension Unit, complete with Lumaclad reflector and 20-foot cord, gives extra light to cover large areas. **$11.00.**

Convert other flash units—Kodak B-C Flashpack replaces two "C" batteries (end-to-end type), converting to dependable battery-condenser power. **$2.95.**

Flash shots with simple cameras—Kodalite Flasholder for Brownie Hawkeye Camera has Lumaclad reflector. **$4.00.** Your dealer has other inexpensive Flasholders, too.

Prices subject to change without notice

Eastman Kodak Company, Rochester 4, N. Y.

4-IN-HAND

(four files in one)

A "must" for the homecrafter

Flat file and rasp on one side; half round rasp and file on other side. (8", 9" or 10" length.)

FLAT surface or curved; deep cut or light—you get quick, sure stock removal on wood, plastics or soft metal with this unique four-faced rasp-file. And its utility is well seconded by its facility . . . flip it over, endwise or sidewise, and instantly you have the face best suited for the job.

A woodworker writes: "This is a fine correcting tool . . . if I can't cut or saw a thing right I make it so with the 4-IN-HAND. It removes the offending material in a jiffy."

GET IT FROM YOUR HARDWARE OR TOOL SUPPLY HOUSE

in either Nicholson or Black Diamond brand

You'll notice the evidences of the 4-IN-HAND's high quality. And while you're about it, why not lay in an auxiliary complement of regular files for your "Do It Yourself" projects? The dealer will gladly help you make a wise selection.

NICHOLSON FILE COMPANY

19 Acorn St., Providence 1, R. I.

(In Canada: Nicholson File Company of Canada Ltd., Port Hope, Ontario)

NICHOLSON U.S.A.

NICHOLSON FILES *FOR EVERY PURPOSE*

[Continued from page 176]

and part of 1938, the doctor continued to visit the fossil gold mine, for that is what it proved to be.

As Broom arrived one fine June morning in 1938, Barlow showed him the palate of a large ape-man, with one molar in place.

Trying not to betray his excitement, Broom said with restrained understatement: "That is a nice specimen. I'll give you a couple of pounds for it."

Barlow was pleased, but evasive about telling where the palate had come from. The matrix was different from that of Sterkfontein, and the doctor felt sure it had been collected from some other site. He questioned the quarry boys; they had not seen it before. Broom dropped finesse. He told Barlow he had to know the source of the fossil; two of the teeth were freshly broken off and perhaps could be recovered. Barlow then held back no further. He explained that he had obtained the palate from a schoolboy, Gert Terblanche.

Bone Pieces Were Scattered About

The words were scarcely uttered before Broom started for the Terblanche farm. Gert, a 15-year-old, was at school, but his mother and sister were at home. The sister led the anxious doctor to a place on a hill where Gert had hammered the palate out of a deposit of bone breccia. Lying around were fragments of bone and a few teeth.

Broom hurried off for the school, walking the last mile because the road was too rough for his car.

Boy's Pocket Is Cache of Four Teeth

At the doctor's questions, Gert pulled out of his pocket "four of the most beautiful teeth ever found in the world's history." Two of the four fitted on the palate; they were the two that had been recently broken off. The other two had weathered off at some earlier time. The doctor bought the teeth from the boy.

Gert said he had another piece of the

[Continued on page 262]

ACs with Patented *CORALOX* Insulator are Built for Both!

The Insulator of AC automotive Spark Plugs is of the same composition as that used in AC jet plugs.

CORALOX has greater electrical resistance at high temperatures than any previous insulator, so it won't let the current "short" and cause your engine to misfire no matter how high the engine temperature. The great strength of *CORALOX* permits the use of longer, thinner insulator tips which heat up quickly to burn away oil and wet carbon deposits. With these major causes of power-loss and fuel-loss eliminated, many a motorist with a new set of ACs . . .

- **STEPS UP POWER BY AS MUCH AS 10%**
- **SAVES UP TO ONE GAL. OF GAS IN TEN**

After your plugs have seen several thousand miles of service, your car's engine will benefit from new ACs with patented *CORALOX* Insulators.

AC SPARK PLUG DIVISION GENERAL MOTORS CORPORATION

B.F.Goodrich
ASPHALT
FLOOR TILE

The EASE of Doing it!

My dealer told me how to install this beautiful, long-lasting floor tile. It's *easy* to do with the B. F. Goodrich installation kit.

The SAVINGS!

I saved plenty by doing it myself . . . the results are something to be proud of. Send for FREE full color folder.

B. F. Goodrich Co., Dept. PS2,
Flooring Div., Watertown 72, Mass.

NAME.....

ADDRESS.....

CITY.....STATE.....

How the Missing Link Was Found

[Continued from page 260]

skull hidden away. The problem was to get him out of school and to his hiding place before dark might halt any necessary investigations.

Broom suggested to the principal that he be allowed to talk to the teachers and the children about their caves and how bones got into them. For more than an hour he lectured to them, illustrating his points with the clever blackboard sketches he often made at the museum. The principal was so pleased that he dismissed the whole school well before the closing hour at two in the afternoon. The boy and the doctor rushed off. When they reached the hill, Gert dug into his cache and drew out "a fine jaw with some beautiful teeth."

Assembled Pieces Were a Surprise

During the next few days the two sifted all the ground around the spot where the skull had been embedded and recovered a number of scraps of bone and tooth. When all the pieces were cleaned and joined, Broom again had a wonderful surprise. He had the greater part of the left side of a skull and the lower right jaw with many of the teeth well preserved.

The skull differed in some important respects from that found at Sterkfontein. The face was flatter, the jaw more powerful and the teeth larger. In this way it was more apelike. In other ways, particularly in the form of the teeth, it was more human. Some people began to be convinced. The *London Illustrated News* captioned its picture: "The Missing Link No Longer Missing."

The war stopped the work in the caves. Soon after the end of the war, General Smuts sent for Broom. The general offered the doctor government support and whatever money might be needed for further explorations.

On April 18, 1947, at Sterkfontein, the doctor and his assistants blasted out a large piece of what looked like unpromising breccia. As the smoke blew

[Continued on page 264]

Texaco Tips

on car care

How to get good automatic transmission performance

If the level of your automatic transmission fluid is below normal, you can't enjoy smooth, efficient motoring . . . and you may run into expensive repairs. See your Texaco Dealer for Texamatic Service. He has taken a special course in automatic transmission care. He will check the fluid level. If it is low, he will add the precise amount necessary. At the mileage specified by your car manufacturer, your Texaco Dealer will drain and refill your automatic transmission with Texaco Texamatic Fluid as required.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

How to get longer engine life

Today's best motor oil is *made* . . . not born. Nature's finest oil failed to meet the tough requirements of today's high-horsepower engines. That's why Texaco engineers developed *Advanced Custom-Made Havoline*. Its Balanced-Additive formula gives your engine the all-around protection against wear that it needs. The results of rugged tests show that tappet "A" was "dished-out" after 100 hours of operation with a good heavy duty oil. Using *Advanced Custom-Made Havoline* for 500 hours, tappet "B" showed *no sign of wear*. Get *Advanced Custom-Made Havoline*—the great motor oil that protects against rust, keeps your engine clean, free from sludge and metal-eating acids . . . actually wear-proofs your engine for the life of your car. See your Texaco Dealer . . . *the best friend your car has ever had.*

CHANGE TO *Advanced* CUSTOM-MADE HAVOLINE
. . . the best motor oil your money can buy

THE TEXAS COMPANY

TEXACO DEALERS

in all 48 states

Texaco Products are also distributed in Canada and in Latin America

TUNE IN: METROPOLITAN OPERA radio broadcasts every Saturday afternoon. See newspaper for time and station.

for fast, clean boring

Greenlee 22
SOLID-CENTER AUGER BITS

Here's the auger bit that makes good workmanship come easy! Smooth, *accurate* holes are bored swiftly because solid-center design gives extra strength and provides fast, positive chip clearance. Every GREENLEE 22 Solid-Center Auger Bit has accurately sized, perfect cutting edges that last through long use. "Induction Heat Treated" for uniformity, long life . . . "Plastic Sealed" to reach you factory-sharp. Available in 18 sizes: from 4/16" diameter through 24/16". Buy singly or in sets attractively packaged in handy plastic rolls, steel boxes or metal holding panels. Stocked by leading hardware and building supply dealers.

SPECIAL OFFER — GREENLEE WOODWORKING CALCULATOR—ONLY 25¢

Converts linear to board feet, gives nail specifications, tool sharpening tips. Compares woods, gives bit sizes for screws, concrete mixes, painting information, etc. Convenient . . . simple to read. 6" diameter circular shape . . . heavily varnished cardboard. Send 25¢ (no stamps please).

TOOLS FOR CRAFTSMEN
GREENLEE

GREENLEE TOOL CO.
2122 Columbia Ave., Rockford, Ill.

How the Missing Link Was Found

[Continued from page 262]

away, they saw a sight almost unbelievable to an anthropologist. A whole, a perfect skull was exposed, standing out like an ivory inlay in the darker rock.

The blast had split it in two—an immaterial matter. The base of the skull was in the block that had broken away. The upper half was exposed in the wall. Small lime crystals had formed in the brain case, which sparkled as though it were lined with diamonds. "I have seen many interesting sights in my long life," the doctor said. "This was the most thrilling of my experience."

Mrs. Ples Was No Beauty

The skull was that of an adult female *Plesianthropus*. Around the museum she promptly became known as Mrs. Ples. Mrs. Ples would scarcely have been considered a beauty by modern standards. Her jaw was heavy and underslung, her nose flat. And yet there was about her an unmistakable quality of humanness.

Mrs. Ples and her contemporaries were beings not yet fully human; they were the links, the long-denied and long-sought transitions between the anthropoids and men. They were the hitherto missing proof of the unbroken descent of life at one of the critical stages of evolution, the jump from anthropoid to hominid—to the human race.

Even before Broom died, on April 6, 1951, at 84, scientific appraisal of his work was making certain of his recognition as the man who discovered the immediate origin of man and mammals.

Another conviction was also growing. The impressive South African ape-man fossils pointed directly to the possibility that man originated in Africa. END

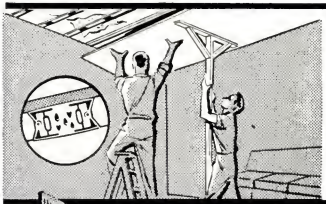
On Solid Ground

A MOUNTAINEER, on his first visit to a city of any size, was fascinated by the asphalt streets. Scraping his feet on the hard surface, he remarked to his boy, "Well, I can't blame 'em for building a town here. The ground's too darned hard to plow, anyhow."—*L & N Magazine.*

- CEILINGS CRACKED?
- NEED MORE ROOM?
- BUILDING A GARAGE?

Use UPSON PANELS

do it yourself, save money, get better finished job!

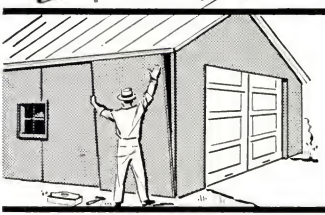


Recover cracked ceilings in a day

Upson Kuver-Krak Ceilings. Apply Upson Ceilings on furring strips right over your old cracked plaster ceilings. They stay anchored from the back with ingenious Upson Floating Fasteners. (See insert). There are no visible nailholes. In just a matter of hours the job is finished. No dirt, no mess. And you have a beautiful, *permanent* and crackproof ceiling. See your lumber dealer. Insist on Upson.

Add beauty to extra room with Striated Panels

Upson Striated Panels. Panel-finish your attic or basement with Upson Panels. And, to add a beautiful modern touch, finish one wall with smart Upson Striated Panels. A contrasting wall adds a professional decorator touch to your room. There's nothing tricky about Upson Striated Panels, either. They're easy to apply, won't crack, shatter, splinter. Take paint beautifully, withstand extra hard jolts. See your lumber dealer.



It's easy to build your own garage

New Upson All Weather Sheathing. Costs surprisingly little. And the superior weather resistant qualities of this super-strong 6-ply Sheathing make it perfect for siding. Cover a garage, utility shed, in no time. Easy to apply, nail direct to studs. No paint required or one coat covers beautifully. Offers good insulation value. See your lumber dealer. Insist on Upson All Weather Sheathing.

Mail coupon for FREE details

OTHER UPSON PRODUCTS

- Strong-Bilt Walls
- Ceiling Tiles
- ¼" Panels
- Easy Curve Panels
- Peg-it Panels
- 3/16" Panels
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PROVEN QUALITY YOU CAN TRUST

PANELS

UPSON

The Upson Company
482 Upson Point, Lockport, N. Y.

Please send me FREE details on

☐ Upson Ceilings ☐ Upson Striated Panels ☐ All Weather Sheathing

☐ _____
(Name of other product)

NAME_____

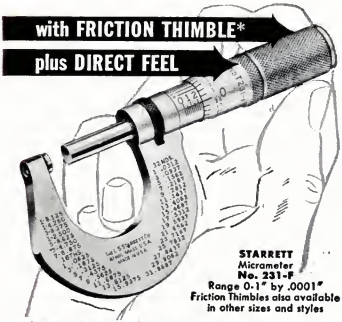
ADDRESS_____

CITY_____ STATE_____

Starrett *Satin Chrome** MICROMETERS

with FRICTION THIMBLE*

plus DIRECT FEEL



STARRETT
Micrometer
No. 231-F
Range 0-1" by .0001"
Friction Thimbles also available in other sizes and styles

***PIONEERED and DEVELOPED by The L. S. STARRETT COMPANY**

Starrett *Friction Thimble Micrometers* give you both *friction control* and *direct feel* in a micrometer designed for easy, one-hand use. An improved friction control mechanism built right into the upper portion of the thimble is "right under your thumb" for fast, accurate, repetitive measurements. Lower section of the thimble is integral with the spindle with location and large diameter just right for quick control and "direct feel" on critical measurements.

Only Starrett Micrometers offer you this modern convenience plus 12 other big features. Get them all by insisting on *STARRETT* Micrometers. Buy through your Industrial Distributor.

FREE STARRETT CATALOG FEATURING NEW TOOLS

THE L. S. STARRETT COMPANY
Dept. PS, Athol, Mass., U. S. A.

Please send Catalog 26A containing *New Tools* section plus 300 page display of the complete line of Starrett precision tools, dial indicators, steel tapes, hacksaws, band saws, band knives and precision ground flat stock.

Name.....Position.....

Address.....

City.....Zone....State.....

New Types of Wood Flooring

[Continued from page 244]

and durability. Higher grades often include somewhat more long pieces.

Lower grades not only are cheaper but are actually preferred by some people because of the interest and character given to a floor by natural defects. Another way to save money is to buy the very cheapest grade and then cut out serious defects.

Starting in each case with the finest—and most costly—variety, the grades of quarter-sawed oak are clear, sap clear, and select. Of plain-sawed oak, the grades are clear select, No. 1 common and No. 2 common.

Beech, birch and maple are graded first, second, third. So is pecan, which is also made fourth grade.

In prefinished oak flooring, grades are prime, standard and better, standard, tavern. Prefinished beech and pecan are offered in one grade, tavern and better.

What thickness? Many special floorings are offered in only a single thickness, but the standard varieties in widest use often come in a choice of several. Thinner flooring is naturally cheaper. And it will do as well if applied over an old floor or a thoroughly sound subfloor.

If the subfloor is doubtful, it is wisest to use one of the thicker types, usually about 25/32". If your floor is to be put down over screeds (sleepers) on concrete or directly onto joists without any subfloor, use flooring at least 25/32" thick.

One last pointer: have your flooring delivered well before you're ready to lay it. You'll get a smoother, tighter floor if you keep the material for four or five days in the house where it is to be used. Stack it loosely in a room heated to about 70° so that its moisture content can become the same as that of the house. Don't store it or lay it in a damp house.

A good floor can be a lifetime proposition. It's well worth your while to select it carefully and treat it right. END

Big Wind

"Quite a blow last night, wasn't it, Elmer?" a farmer remarked to his neighbor.

"Yep, shore was," replied Elmer.

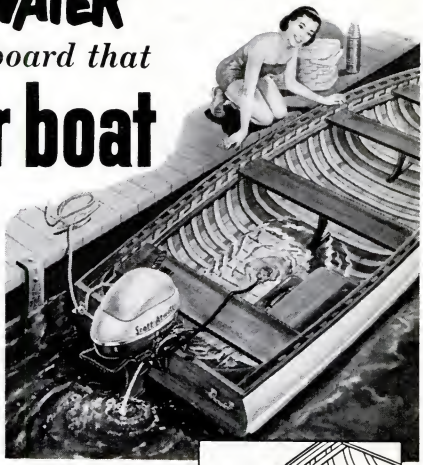
"Damage your barn any?" questioned the first man.

"Dunno," replied Elmer. "Hain't found it yet."—*C & O Tracks.*

SCOTT-ATWATER

gives you the outboard that

bails your boat



Here's the most talked-about outboard improvement in years! The new Scott-Atwater with *Bail-a-matic* pumps your boat dry, keeps it dry . . . automatically!

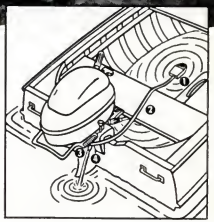
And *Bail-a-matic* is just one of the exciting features of the 1954 Scott-Atwater line: *Aquablade* Lower Unit, a great new development in outboard engineering; *Pillowed Power* for quieter, smoother cruising; *Stowaway* Gas Tank; *Complete* Shift (forward, neutral, reverse); *Twist-Grip* Speed Control; Carburetor Drain; Remote Control Connections and many others.

Horsepower Certified by OBC. F.O.B. factory prices subject to change without notice.

HERE'S HOW BAIL-A-MATIC WORKS

Water is drawn into screened immersion unit (**1**), and flows through neoprene bilge hose (**2**) to vacuum-type *Bail-a-matic* pump (**3**). The water *does not* circulate through the cooling system; it is immediately expelled (**4**) via completely separate outlet.

The *Bail-a-matic* unit works at any motor speed, in or out of gear . . . bails more than 150 gallons per hour.



FREE 16-PAGE BOOKLET tells the whole story of the sensational Scott-Atwater for 1954. For your free copy, write Scott-Atwater Mfg. Co., Inc., Minneapolis 13, Minn., Dept. PS-24.

Meanwhile, see *Bail-a-matic* in action at your nearest dealer's. Look for his name in the phone book classified section.

FOUR NEW MODELS WITH

Bail-a-matic

5 HP	7½ HP	10 HP	16 HP
$209.50	$229.50	$279.50	$339.50

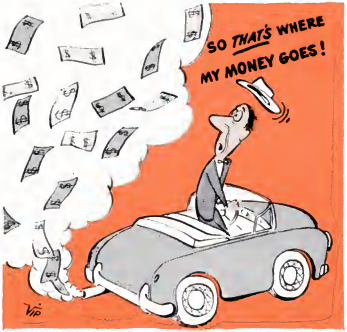
Also, 3.6 HP super single, a powerful, dependable lightweight, and a great value. Only $109.50.

SCOTT-ATWATER

The first outboard in history that

bails your boat

SCOTT-ATWATER MFG. CO., INC., MINNEAPOLIS 13, MINN.



This oil-pumper needs Tough-but-oh-so-Gentle Piston Rings

Oil pumping is just the start of expense and trouble—the first danger signal from worn-out piston rings. The longer you let those rings stay in, the more oil you use, the more power you lose, and the bigger your repair bill.

As your engine gets older, it runs hotter because of accumulations in the cooling system. Cylinders wear tapered and out-of-round—need more oil on the walls.

It requires a special type of piston rings—replacement rings—to deliver this extra oil, under full control, without waste. Hastings makes replacement rings exclusively, devotes all its research on the highways and in the laboratory, to the particular replacement problems of each make and type of engine.

That's why Hastings Rings *stop* oil-pumping, *check* cylinder wear, *restore* engine performance—in re-ring, re-bore and re-sleeve installations.

So go to your motor specialist at the first sign of oil-pumping or performance drop-off. If rings are the trouble, ask him to install a Hastings Steel-Vent replacement set. Truly the best money you can spend on your car! Hastings Manufacturing Company, Hastings, Michigan; Hastings Ltd., Toronto; Piston Rings, Spark Plugs, Oil Filters, Casite, Drout.

TOUGH-but-oh-so-GENTLE

TOUGH on oil-pumping

GENTLE on cylinder walls

HASTINGS STEEL-VENT PISTON RINGS *Regular or Chrome Faced*

[*Continued from page 141*]

how sweetly it comes, how long the engine will work for you.

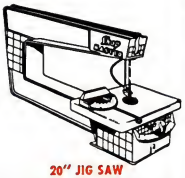
No droop. The solid, chunky look can be deceptive. Some engines sag as much as a sixteenth of an inch on their mounts from weight alone, and deflection is greater under combustion pressures and torque loads. This pliability—which often occurs chiefly in the block-to-bell-housing joint—is murder on smoothness and engine life, and is quite as much a design flaw as an engine that's fat with iron.

Ford people are proud of their OHV block. Ticking off its virtues, they cite a husky box structure with a big array of internal stiffening webs. The crank is brought up inside, giving much greater support for the five main bearings. Where the block bolts to the bell housing, attachment points are much lower and wider than before, to prevent that regrettable sag. Engine mounting positions are also rearranged: the front mounts are farther back, and there's a new "steady rest" in front.

The old crank had three main bearings, weighed 65 pounds, and in recent years coped with more power than it was designed for. Although the new one is 16 pounds lighter—an important saving on a rotating part—it also manages to be notably stiffer. This hat trick is not just because of the two extra mains, though they help. It is another benefit of the shorter stroke, which allows a ⅝-inch greater overlap between the main journals and the crankpins.

Valve train. There are no hydraulic lifters in this engine. Oddly enough, there is almost no clicking, hot or cold. Ford says that the answer is partly mathematics and partly metallurgy. An electronic-computer program helped work out new cam ramps with just the right shape to get along civilly with their tappets. Expansion coefficients of various alloys were neatly paired so that the system wouldn't go off beam with temperature changes. The word is that a properly set-up engine will stay quiet

[*Continued on page 270*]



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10" TILTING TABLE BAND SAW

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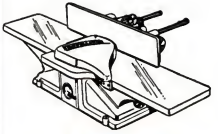

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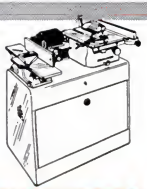

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Division of American Car and Foundry Company

[*Continued from page 268*]

for about 15,000 miles, by which time enough slack will have accumulated to let her click. Resetting the clearances then, a simple service job, will silence her for at least that mileage again.

Ford has gone from a gear drive for the camshaft to a chain, using a husky one that is a full inch wide—bigger than a Cadillac's. Both intake and exhaust valves have free-turning rotators. Also new is a clever little valve-stem seal—first worked out for the six—that licks a mean problem in valve-stem lubrication (too much oil on the stem dribbles down into the combustion chamber, giving smoke and a bad reputation; too little means wear). The seal is a little synthetic-rubber umbrella on the stem, inside the spring, that jogs up and down with the valve. The umbrella lets enough oil mist reach the stem to oil it properly but deflects solid drops.

To old hands who have fitted replacement valve-stem guides in many an overhaul, one part of the new engine may be a shocker—there aren't any valve guides. The valve just rides in the cast-iron head.

Cools valves. If you raise an eyebrow, Ford engineers climb all over any theory that this is corner-cutting. By dispensing with the extra joint where a separate guide would be pressed in, one heat-flow barrier has been eliminated, cutting exhaust-valve temperatures by as much as 160°. Old bushings not only gave hotter valves but they tended to wear fast, usually growing bell-mouthed at the unsupported end. Cast-iron guides hold size much longer, and can of course be reamed oversize and fitted with larger valves if an engine has a hard life.

If the eyebrow is still up, Ford engineers deliver the clincher: the integral guide has done elegantly on the six, on truck engines, and on the Lincoln.

Will it last? You can never be sure with a new engine—an owner is the ultimate test driver. But the OHV job doesn't look to be a sensitive plant. For one thing, it leans on experience with the

[*Continued on page 272*]

Amazing A-MP TOOL for Making ELECTRICAL CONNECTIONS

TERMINALS, CONNECTORS AND INSULATORS INCLUDED WITH KIT

CRIMPS Terminals on wire. In one easy operation the tool crimps Terminals and Connectors for safe connections.

SPLICES WIRE Prepares wire for crimping Connector, making quick, firm splice.

You and every home craftsman as well as every professional need this wonder tool because it simplifies, improves and speeds up the job of making solderless electrical connections.

Ends the old way of forming electrical wiring connections, cutting, splicing or stripping wire. With this A-MP Tool you can make all wiring work a "professional-like" job. Terminals, furnished with the tool, are crimped onto the wire then neatly fitted to the terminal stud. Splicing and making a fresh wire connection are easy with the A-MP Tool. You simply insert the exposed wire ends in the connector barrel, furnished with kit, then crimp both ends and cover the connectors with the insulating tubing—result, a perefct job in minutes. And stripping wire is a joy with the A-MP Tool. Just a clean cut through old insulation, then a quick jerk and the wire is stripped clean and ready for Terminals or Connectors.

Formerly $5.00 NOW $3.95 COMPLETE KIT POST PAID

CUTS WIRE Makes a sharp, clean bite through wire and insulation leaving no loose, straggly strands of wire or insulation.

STRIPS WIRE Cuts through insulation and when loose fabric is pulled off leaves strands clean and tight and of proper length for crimping.

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The Champ A-MP tool shears bolts — either steel or brass without damage to the threads, and leaves no burrs to file. This is an added feature.

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If your dealer hasn't the Champ A-MP Tool you can order it direct. Satisfaction guaranteed or your money back. Mail coupon, enclosing check or money order for $3.95. Tool is sent postpaid. Extra supply of Terminals, Connectors and Insulators always available.

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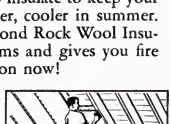
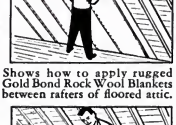
Tells how to install Gold Bond Rock Wool Blankets between joists of unfloored attic.



Shows how to apply rugged Gold Bond Rock Wool Blankets between rafters of floored attic.

If room already built, shows how easy to insulate with Gold Bond Rock Wool Blankets.



In attic with joists not of standard spacing, shows how to use Gold Bond Pouring Wool.

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The New Ford Engine

[*Continued from page 270*]

Lincoln and the six. For another, the company has spent 125,000 man-hours on design, 50,000 hours on dynamometers.

For a third reason, the new engine has done theatrically well on destruction tests. If you run her wide open on a dynamometer, delivering high power above maximum rated speed, *and with the spark set for continuous heavy knock,* she'll scream for around 200 hours before something lets go. (Typically, a piston gets holed.) This is three to four times as long as some perfectly satisfactory engines will take similar abuse.

Complaint dept. In one respect the new engine won't please owners who are Saturday-morning mechanics: it is a dog to work on. The plugs are tucked horizontally under the exhaust manifolds. You can only change the oil-filter cartridge from underneath. The distributor, slanting up out of the valley at the back of the block, isn't as insanely inaccessible as it was in the pre-'49 V-8s. But it still isn't nearly as handy as in the '49-'53 engines, for a pair of heater hoses run smack over it. The generator is tucked away under the right cylinder bank.

Ford already has its guard up against criticism on accessibility. An overhead-valve V-8 doesn't naturally stick a plug out at you like a tongue at the doctor. Water-pump and block considerations dictated location of the distributor. The generator now has prelubricated bearings at both ends, on the sound theory that an oil cup would often be overlooked in the new spot. As for the underneath oil filter, Ford asks, with a shade of testiness, who's going to change a filter cartridge without getting underneath to drain the oil anyhow? END

Rays of Hope

In the waiting line at a mobile tuberculosis X-ray unit in downtown Dallas recently, an attendant asked a woman whether she wanted her chest X-rayed.

"Yes, sir," the woman told him. "I've had it done five times already and it sure is helping."
—*T & P Topics.*

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The Great New *Atlas* 3021 8" TILT/ARBOR, BALL BEARING CIRCULAR SAW

Here's a brand new saw that'll do everything you've ever expected of an 8" circular . . . FASTER, SMOOTHER, EASIER and MORE ACCURATELY than you'd have believed possible. It's designed for efficiency . . . engineered to exacting standards for smoothest operation and long service . . . built for rigidity and styled along the most modern structural lines. Never before such value . . . STUDY THESE FEATURES.

- **NEW** MODERN STRUCTURAL DESIGN . . . for accurate work.
- **NEW** PUSH-PULL DUAL CONTROL . . . one handwheel for blade height, angle.
- **NEW** LARGER ARBOR AND SEALED-FOR-LIFE BEARINGS.
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- **NEW** DUAL V-BELT DRIVE . . . full power for every job.
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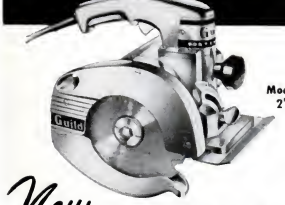

Model A6
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New PORTER-CABLE 6" SAW

with exclusive Kick-Proof Clutch

Only $65.00

When the ordinary electric hand saw hits a knot or hard spot . . . *watch out!* It may kick like a mule . . . even throw itself backward out of the cut. There's always the possibility that you'll be caught unawares — the saw damaged — or the work ruined.

But not with the new Porter-Cable Kick-Proof Saws! The special Kick-Proof Clutch absorbs all kick back . . . gives you greater protection . . . prevents motor burn-out and stripped gears . . . eliminates gouging of lumber from loss of control.

MORE ADVANCED FEATURES

Model A6 wraps up in one saw all the latest improvements in advanced design. Calibrated quadrant assures accurate bevel cuts. Helical gearing delivers more cutting power to the blade. Depth of cut adjustment is instantaneous. Precision ball bearings throughout. Sturdy aluminum base and frame keeps weight down to a mere 12 pounds for easier, less tiring sawing.

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Address.....
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Manufacturers of Speedmatic and Guild Electric Tools

Buick Adds Power

[Continued from page 149]

The looks of the new Buick are how you find them. The windshields are wrapped around like those of the new Olds and Cadillac. The swing-out hinges on the doors are mounted forward, and the door itself has an L-shaped notch in it, as though an elephant with pie-shaped dentures had taken a sample.

Me, within 10 minutes I was hopelessly gone on a Super hardtop, its rear whitewalls exposed delicately like a woman's ears under an upswept hairdo.

Body Lines Are Smoother

The fact is, in my opinion the new Buicks are mighty pretty. Bodies and rear fenders have been sleeked down.

All the Buicks are lower, some of them by as much as three inches. The hardtops excepted, the roofs of the Supers and Roadmasters extend beyond the tops of the windshields to make short sun visors.

Hoods are lower, too. At the cowl, the Special (and Century is the same) measures a full three inches lower to the ground. The Super's and Roadmaster's hoods are down an inch and a half. The front fenders are up, all of them by three inches, and you can see that right front crown from the driver's seat.

You no longer have to guess whether you're going to clip the guy you cut out to pass on the open road.

Hoods aren't any shorter, though. Shorter engines have created at least a foot of air space between radiators and grilles, but manufacturers still figure that they have to make a big man out of the motorist by giving him a long hood.

The new Buick speedometer replaces the familiar needle indicator with a creeping red line on an instrument face graduated horizontally. As the speed increases, the red line moves like the one in a spirit thermometer.

For 1954, Buick retains one of its oldest features. The company remains one of two in the U. S. (Nash Ambassador is the other) using a torque-tube drive. That means it sheathes the propeller

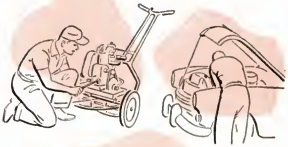
[Continued on page 276]

Start your collection of FINE TOOLS

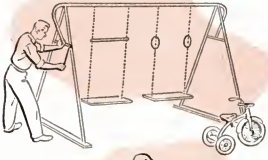
with this

BONNEY SOCKET SET!

Here's the most practical basic socket set for home and shop. It contains twelve of the most useful ½″ square drive double-hex sockets, together with a 15″ hinge handle and an 8″ cross handle. Available in either a cardboard or metal box.



With this Bonney Socket Set, you can make quick work of repairs and adjustments on lawn mowers and garden tractors, automobiles, washing machines and other household appliances.



Take a tip from professional mechanics who call Bonney wrenches America's finest—make Bonney *your* choice. Start with a Bonney No. AA8 Standard Series Socket Set. Then add to your collection of *fine* tools from time to time by buying the Bonney wrenches *you* find most useful. They're available in open stock or complete sets. Ask your dealer for Bonney. If he doesn't have the No. AA8 Socket Set in stock, he can get it for you. Or write us direct.

BONNEY TOOLS

Note! The economy-minded home mechanic or hobbyist will find Bon-E-Con tools especially suited to *his* requirements. They are tools any man would value at prices anyone can afford. And Bon-E-Con tools carry the same guarantee as Bonney tools.

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Peel off old paint
FOR A BETTER JOB

Why try to paint over a cracked, checked or broken finish . . . when it's so easy to "peel it off" with Klean-Strip? This modern remover leaves the surface clean, smooth and dry—ready for a better, longer-lasting paint job. Non-inflammable Klean-Strip works fast on all type finishes. Needs no afterwash or neutralizing . . . saves labor and materials. Buy it when and where you buy paint.

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Try This Shaving Magic
AERO SHAVE "Push-Button" LATHER

Best Shave News In 50 Years!
- Richer, Creamier Lather
- No Brush Needed
- No Greasy Cream
- 3 Beard Softeners
- Contains Lanolin

AERO SHAVE *Lather Bomb*

[Continued from page 274]

shaft in a steel cylinder attached on one end to the rear-axle casing and at the other to the transmission case. The more popular Hotchkiss drive is a naked prop shaft.

Every year, critics of the torque tube expect Buick to abandon it. Every year, Buick fools them. Ivan Wiles, general manager of this GM division, and his engineers have created a reasonable explanation for hanging on to a drive that costs them more to produce.

The Hotchkiss drive transmits torque to the differential and rear axle. That becomes push at the rear wheels. All the push transmitted to the chassis and body goes through the rear springs.

Prop-Shaft Cylinder Acts as Lever

The springs have another function: when the accelerator goes down, the rear-axle casing tries to turn backward, in a direction opposite to the rotation of the axle itself. It's restrained mostly by the rear springs.

The torque-tube drive does it differently. When the rear wheels start turning, the push on the chassis comes through the transmission housing. It gets there by traveling along the cylinder that sheathes the prop shaft. Moreover, this cylinder acts as a king-size lever on the rear-axle housing to keep it from turning when a motorist steps on the gas.

In braking, the snubbing action on the rear wheels puts reverse English on the whole process.

New Springing Is Softer

According to General Manager Wiles and his crew, the real payoff on the torque tube is the latitude it affords the engineers in springing a car. All that the springs have to do is hold up what's above the running gear. Springs can be softer. That's the reason for coils all around on a Buick.

The company says a torque-tube car keeps its direction better, too. When the push from the rear wheels is applied

[Continued on page 278]

Try My "FAMILY FORMULA" For GETTING YOUR COMPLETE WORKSHOP

Build your one-motor DELTA SHOP this ideal way— A TOOL AT A TIME!

FIRST I BOUGHT THE BASIC SAW AND STAND

. . . and that gave me the tool to do the sawing operations that are needed on every job. The DELTASHOP'S big tilting blade saw does many other important operations, too—such as cutting grooves, decorative moldings, etc.—and its accuracy helps me do work like a professional.

Saw and stand, less motor $109.80

LATER, MY WIFE GAVE ME THE COMPANION JOINTER-PLANER

To do any finished-looking job you must plane the edge of a board right after you rip it. The Delta jointer planes boards up to 4" wide . . . does operations such as tapering and rabbeting, too.

Jointer, complete $49.15

THE DRILL PRESS WAS A GIFT FROM MY FOLKS

In addition to doing accurate drilling, the Delta drill press made it possible to make mortises, do routing, carving, sanding, polishing, make beautiful shaped edges . . . actually it's a "master of all trades."

Drill Press. $57.50

MY KIDS JOINED FORCES TO GIVE ME THE SANDER

This handy, low cost tool is perfect for finish-sanding jobs—has many other uses, too.

Sander. . $17.55

Ask about the DELTASHOP "tool-at-a-time" plan today—at your Delta dealer, department store or nearby hardware store. Then start building your complete workshop this easy, low-cost way. *Delta Power Tool Division, Rockwell Manufacturing Company, 504B N. Lexington Avenue, Pittsburgh 8, Penna.*

Prices slightly higher west of the Rockies

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Another Product by **Rockwell**

DELTA MILWAUKEE

DELTA QUALITY MAKES THE DIFFERENCE

TIPS for the HANDYMAN

ON USING L·O·F SUPER-FINE FIBER-GLASS

Here's a new insulating product of "1001 uses:" Wonderfully easy to handle and apply. And so versatile, so effective, you'll find uses for it in a dozen places 'round the house.

Save fuel by wrapping fire-resistant Super·Fine around your heating ducts! Highly efficient *heat* insulation. Flexible, lightweight, easy to install.

Reduce dripping from *cold* water pipes. Reduce heat loss from *hot* water pipes. Spiral wrap them with Super·Fine. Will not mildew or rot.

L·O·F Super·Fine installed under the hood of your car reduces airborne noise, tire whine and air-stream whistle.

Sound-Insulate your home workshop! L·O·F Super·Fine provides excellent *sound* absorption. Cuts easily with scissors or knife.

Get L·O·F Super. Fine at your favorite hardware dealer's, where this rack is on display. If your dealer doesn't have it, write Libbey·Owens·Ford, Fiber-Glass Division, 4924 Wayne Building, Toledo 3, Ohio.

LOF GLASS Corrulux FIBER-GLASS

FIBER·GLASS

[Continued from page 276]

halfway up the frame, it's easier to hold on the road.

There are disadvantages to the torque tube. For one thing, it can get noisy unless a lot of care is taken to damp out vibration. For another, there is more unsprung weight, and the car tends to pound on rough roads. But this is a Buick story, and people who like Buicks don't like to admit *any* faults.

Fancy "Front-End Geometry"

Buick has raised the ante on its directional stability for '54. They have done some interesting things to what the engineers, in their professional gobbledygook, call the front-end geometry. The result is that the car tends to understeer. Put it in a turn, and you have to hold it there. The front wheels don't go whinnying off in the new direction without a backward look at the driver.

I discovered a most welcome additional gizmo the moment I slid behind the wheel of a new Super at the proving ground. Driving a Buick in the winter had always required a cockpit check-out to operate the heating system. Now all you do with the new airplane-type controls is push 'em up and pull 'em down. At one end they're marked "Summer," at the other, "Winter."

When I rolled to a stop after a couple of hours of pleasant driving on rough roads, smooth roads, winding roads, straight roads, on hills and on the high-speed loop of the big test track, I remarked to a Buick engineer that the car was mighty quiet.

"Didn't you people have a whine in the transmission at about 20 miles an hour?" I asked.

"Yes," he said, "we did, last year. But we fixed it. It was just a thing—a gizmo, you might say." END

Definition

PATIENCE is the ability to idle your motor when you feel like stripping your gears.—*Public Safety.*

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...steals the show in home improvement field!

Reynolds *Do-It-Yourself* Aluminum is so easy to use that even the most *amateur* home owners are becoming "professionals" overnight... and saving lots of money in the bargain. The secret? This new kind of aluminum is specially engineered for really astonishing workability. You can bend it, saw it, drill it, plane it, join it and shape it, using ordinary hand or power tools.

New Reynolds *Do-It-Yourself* Aluminum comes in plain and embossed sheets, tubes, bars, rods, angles, screen and storm sash sections. Reynolds Reynolon film, and handy, easy-to-use fasteners.

"Easi-Bild"* patterns of the projects pictured on this page can be obtained for a small cost by filling in the coupon below. Each pattern contains complete list of materials needed. Also at your dealers, free, are (1) instructions for making aluminum screens and storm sash, and (2) a "how-to" booklet containing general instructions and suggested projects. Or send coupon.

Reynolds *Do-It-Yourself* Aluminum won't harm ordinary tools. Its use is approved by leading tool manufacturers. Home owners are cautioned, however, to use *only* Reynolds *Do-It-Yourself* Aluminum, because other types may harm ordinary tools. Reynolds *Do-It-Yourself* Aluminum can be identified by the special Seal attached to every piece.

Stunning desk and lamp are beautiful examples of the versatility of Reynolds *Do-It-Yourself* Aluminum. Patterns #542 and #541.

Radiator cover made of Reynolds *Do-It-Yourself* Aluminum is handsome, efficient . . . costs surprisingly little. Save up to 75%. Pattern #544.

This sewing center will win any homemaker's heart. Yet it's a simple, inexpensive project. Pattern #543.

Reynolds *Do-It-Yourself* Aluminum is now on sale at hardware and lumber supply dealers in this handy self-service rack.

No special tools are needed to make and repair things with new Reynolds *Do-It-Yourself* Aluminum. Saw it, plane it, join it, shape it, drill it with ordinary hand or power tools.

*T.M. Reg. Easi-Bild Pattern Company

SEND FOR "EASI-BILD" PATTERNS

Reynolds Metals Company
2503 South Third Street,
Louisville 1, Kentucky

Please send me the following *full-size* "Easi-Bild" Patterns. I enclose_____ in cash or money order.

- ☐ LAMP No. 541 . . . . . 35c
- ☐ DESK No. 542 . . . . . 50c
- ☐ SEWING CENTER No. 543 . 50c
- ☐ RADIATOR COVER No. 544 . 50c
- ☐ ALUMINUM SCREEN, STORM SASH instruction folder . . . . . FREE
- ☐ "HOW-TO" BOOKLET with instructions and projects . FREE

Name _____

Address _____

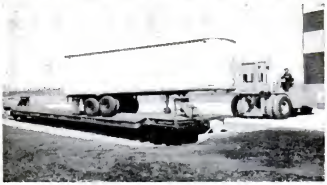
City _____ Zone _____ State _____

Offer limited to the Continental U. S.

World's Biggest Ball Awaits Atomic Submarine's Engine

TALL as an 18-story building and 225 feet across, the biggest steel ball in the world is now ready for the atomic-sub engine it will test. How the last sections of the sphere were set in place is shown at right. The massive housing at the Knolls Atomic Power Laboratory, West Milton, N. Y., is extra insurance, GE engineers say, against the remote chance that all safety devices fail simultaneously. The submarine hull, built alongside the ball, will be skidded in through a hole. Water will float the hull to simulate seagoing conditions.

Loaded Trailers Ride the Rails to Bypass Traffic and Haul More



A NEW railroad car designed to carry loaded truck trailers may cut traffic on main highways. Semitrailers are driven to the nearest railroad freight yard, unhooked and loaded aboard a special flatcar (left). When unloaded many miles nearer their final destination, truck tractors pick up the trailers and complete the delivery. The track-riding General Motors transport car can carry two trailers.

"We took a tip from the auto industry to give you a new kind of drill"

says Paul Jones, President, Cummins-Chicago Corp.

There's an amazing story behind Cummins Ball•Rite 44. It revolutionizes ¼" drill performance.

Until we invented the Ball•Rite principle the craftsman either had to pay a very high price for industrial quality drills—or buy low priced drills that did not meet the performance desired.

We knew that if industrial quality drills could be produced in volume and certain production and engineering prejudices eliminated, their price could be brought down so low that everybody could have their super performance and long life. The answer was to build a product that met industry's high performance standards and produce it at a price that everybody could afford.

The early automobile manufacturers had pretty much the same problem. It was the legendary Ford that combined in one automobile the stamina and durability required by business with a price level that made the automobile the every-day necessity of every family. When the tremendous sales volume of these two markets was combined in one product, sales soared and true mass production was born.

Now, that's exactly what has been accomplished with Cummins Ball•Rite drills. We designed the drill for industrial use and the Ball•Rite 44 today is being used in airplane, automotive and manufacturing industries side by side with drills costing one-third more. Then, by using continuous conveyor belt assembly (instead of the old bench method) we were able to rev production up to hundreds a day and produce the same drill within the price range of the ordinary home-type drill. Instead of having to sell this new Ball•Rite 44 above $40, we were able to price it at $29.95. Both industry and the home user benefitted.

Actually, Cummins took a tremendous gamble in setting up huge volume production lines, but we did it with the confidence that if it could happen in the automotive industry it could happen in the drill business. Our gamble paid off. Both you, the consumer, and industry, bought the Ball•Rite 44 because it gave you performance you would never have been able to touch before at the price.

Every Ball•Rite drill carries the Ball•Rite tag giving its basic industrial specifications. As far as we have been able to find out, it is the only drill on the market carrying a printed tag describing its basic qualities. Here's the tag:

WHAT BALL•RITE MEANS TO YOU

Ball•Rite Construction is a combination of the finest specifications in an electric tool and includes:

1. Ball Bearings in the right places.
2. Always Hardened Gears.
3. Always Double-Coil Motor (type always used in industrial drills).
4. Always Dynamically Balanced Armature for smooth flowing power.

So, before you buy any drill get a Ball•Rite 44 into your hands and switch it on. You will feel smooth, abundant power that can only be matched in $40 industrial drills. That power in the 44 drills ¼" in metal in its stride, handles 1" drilling in all kinds of wood, and with carbide tip drills, drives up to ½" holes in concrete.

Say, you know we even use this Ball•Rite 44 drill to power the famous Cummins **do-it Shop** . . . that combines the 7 most wanted home shop tools in one. The 44 is one of the few drills with enough power to handle all the jobs we ask it to do in the **do-it Shop!** To give you an even better picture of this drill's tremendous power, I will be happy to send you a free copy of the beautifully illustrated and interesting "Cummins **do-it Shop** Booklet." This will show you the many time and money-saving operations you can perform when you own a Ball•Rite 44 drill. Please write to me for your free copy today.

The Ball•Rite 44 is sold not only by industrial distributors selling to industry but in your local hardware store. We hope you will be one of the first in your neighborhood to own one of these amazing new drills, to learn the real satisfaction and performance you get from every one of Cummins popular priced, top quality tools.

Sincerely, Paul Jones
PRESIDENT

CUMMINS-CHICAGO CORP., 4740 N. Ravenswood Ave., Chicago 40, Ill. In Canada: 334 Lauder Ave., Toronto 10.

Makers of MAXAWS, MAXDRILS, BALL•RITE, PERM-ALIGN DRILLS, FIXMASTER KITS, DO-IT SHOP

Copyright, 1955, Cummins-Chicago Corp.

WONDER-PASTE

For a quick, easy job in removing varnish, paint, enamel, etc., try Wonder-Paste — *it's different.* Applied with a brush, it softens up the finish so it comes off easily — not coat by coat, but in one scraping. Will not run on upright surfaces. Use it on furniture, trim, floors, etc. At paint and hardware stores.

Write for leaflet and advice on your removing problem.

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Send me free catalog. Occupation _____

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America's First Turbo Car

[Continued from page 161]

off the driver's braking foot in keeping it stopped.

As yet, it's something of a mystery car. While it has been driven both at GM's proving ground in Milford, Mich., and on the company's five-mile circular track at its desert proving ground near Phoenix, the engineers haven't opened it up. They don't know what it's capable of.

They know it's tricky. It carried Charles L. McCuen, vice-president in charge of research, over a retaining wall at the test track at Milford. Nobody, including McCuen, knows how it happened. Despite the experience, McCuen retains an absorbing interest in turbines.

Caltech Tests Firebird Body

The idea of the Firebird originated with Harley J. Earl, vice-president in charge of styling. He also designed its plastic body. The body was tested in a wind tunnel at the California Institute of Technology.

The Firebird isn't the world's first gas-turbine car. That was built by the Rover Company of England (PSM, June, '50, pp. 98-104). Nor is it the first gas-turbine vehicle in the U. S. The Boeing Airplane Co. has tested turbines in trucks (PSM, Feb. '52, pp. 163-65). But it's the first U. S. high-speed turbine "test bed" on wheels.

Exhibited late in January at GM's annual Motorama at the Waldorf-Astoria Hotel in New York, it will be tested further by engineer-driver Mauri Rose, three-time winner of the Indianapolis 500-mile Memorial Day classic.

His job is made easier because the Firebird can broadcast. Rose quotes instrument readings into a microphone for other engineers who follow him around the track in a radio-equipped station wagon.—*Devon Francis.*

End Men

NOBODY in the world is as suspicious as each man at the end of a crosscut saw.—*Wall Street Journal.*

IT'S NEW!..the Greatest JIG SAW VALUE of All Time Only $23.50

Compare it! Try it!

Dollar-for-Dollar,

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Out-performs Them All!

- **Amazing Capacity!** Cuts 1½" wood, 1" plywood, metal, plastic—as fast as you can follow a line!
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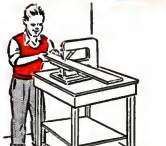
- **Sensational "Rocker Action"!** This revolutionary new principle makes other jig saws out-of-date. Blade is held under constant tension, cannot whip or buckle, lasts far longer!
- **Safest Ever Built!** Blade is completely guarded against finger injuries. Safe for children!
- **Saws Any Direction!** 4-way blade holder takes any length stock. Table raises and lowers so you can use every tooth in the blade. Tilts 45°!

HERE'S JIG SAW MAGIC TO AMAZE YOU! The new DREMEL does more work—faster, easier—than any jig saw anywhere near its price. Driven by a real rotary motor (not a vibrator) it will cut as fast as you can feed the wood. It takes right angle turns at top speed, cuts intricate scrolls impossible for other jig saws. Yet it's rugged enough for major household repair jobs! Use it to make lawn furniture, valances, toys, hundreds of practical projects. The new DREMEL Moto-Jig Saw is so superior to competing models that we challenge you to match it against others costing many dollars more. You'll agree it's the greatest value in jig saw history!

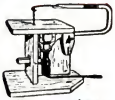


Hobby Project or Household Repair . . . Do it with Dremel—and Save!

ANOTHER LONG-TIME FAVORITE WITH CRAFTSMEN!

DREMEL *Electric* MOTO COPING SAW

A genuine craftsman's tool with dozens of household and workshop uses. Lightweight . . . easy to operate . . . perfect for knick-knacks, corner shelves, intricate scroll work. Cuts through ¾" wood, plastics, rubber and asphalt tile, etc. Perfectly safe for children—women love to use it too! Has only two moving parts, never needs oiling. Unique 4-way blade holder permits cutting any direction—no limit to length of stock it can handle.



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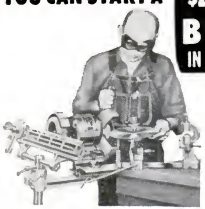
YOU CAN START A $40 A DAY BUSINESS IN YOUR SPARE TIME



Andy Phillips says: "My BELSAW Sharp Smith gives me big profits at low expense — I can run 35 to 40 circular saws in an 8-hour day — that makes me $40 cash."

"I also get BIG EXTRA PROFITS . . . up to $4 an hour . . . by grinding planer and jointer knives — there's always a demand for this kind of work."

You can start this REPEAT CASH business in your own home or garage while you are working at your regular job. Easy to operate, no experience needed. "Pays for itself from just 65 jobs." — *Harvey Jensen*

For as little as $15 down payment, you can get your BELSAW SHARP SMITH rushed to you.

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YOU can start making money the very day your BELSAW SHARP SMITH arrives. Earns $4 to $5 an hour in your SPARE TIME sharpening and setting circular saws for builders, lumber yards, factories...Plus BIG EXTRA CASH, precision grinding planer and jointer knives, plane irons, wood chisels and drill bits. Hundreds of jobs in your own neighborhood. No extra equipment needed, no canvassing. Send today for your Free copy of "Life-Time Security."

LIFE-TIME SECURITY YOUR OWN BUSINESS

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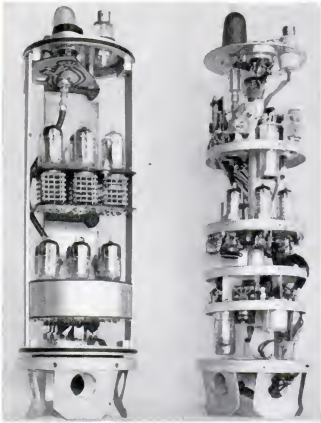
4406 Field Building Kansas City 11, Mo.

Plug-In Motor Runs Soapboxer

UNDER the hood of this crate there's a quarter-horse motor with an extension cord that plugs into a garage outlet. An accelerator pedal starts and runs the motor and a V belt drives the wagon's right rear wheel. At the foot of the driveway, the tug of the cord warns Mike Goff of Claremont, Calif., that he's at the end of his rope.



Navy "Simplifies" Electronics

PROJECT TINKERTOY has mechanized the production of electronic gear for the Navy. At a pilot factory, standardized "building blocks" roll off assembly lines to be strung together by hand or machine to form apparatus like the submarine detector at left above. An equivalent piece of equipment, soldered and wired by hand, is at right.

NEW! GIANT 1954 CATALOG OF Automotive Parts and Accessories

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You can save even more by "Building Your Own" with this Hobart generator. Just connect the "Build-Your-Own" to your own used auto engine . . . it's perfect for small operations which do not justify a complete, factory built outfit.

AC Welder with AC Power for tools
The AC-AC Welder and Power Unit lets you do numerous repair jobs where no power is available . . . also furnishes emergency power for electric lights and power tools. 200 or 300 amp. size plus 5KW AC power.

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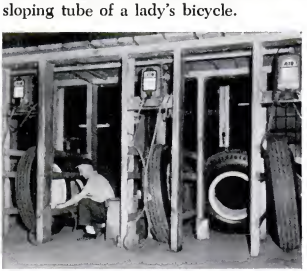
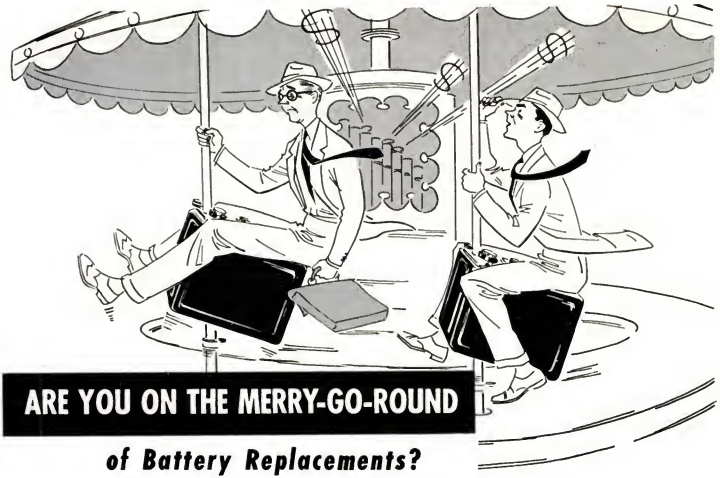
Family Rides on Two Wheels

A TANDEM bike is fine fun for courtship days. But with marriage and a growing family, something must be added to handle the transportation problem. Easily attached child carriers are the solution offered by Dawes Distributors, Cambridge, Mass. Illustrated above in triple arrangement, they take the Joseph Finn family on its Sunday outing. Inset photograph shows how a seat can be attached to the sloping tube of a lady's bicycle.



Safety Racks for Big Tires

A BLOWOUT while blowing up a high-pressure truck tire can kill a man. To prevent such accidents, the White Motor Co., Ardmore, Pa., built these steel-frame stalls to protect tire-maintenance men who handle pressure up to 90 pounds.



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ITEM #178

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ITEM #91 — Type R-1, Rated 300 Amps.—30 Volts. Mfd. by Jack & Heintz. Gov't. Acq. Cost $380.00. Shpg. wt. 55 lbs. Dimensions 16" x 10" x 7". F.O.B. Chicago .. **35.00**

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GENERAL MOTORS —ALLISON 200 GALLONS

Brand New

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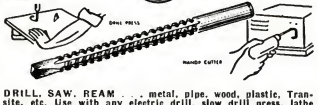

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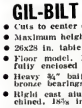

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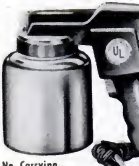

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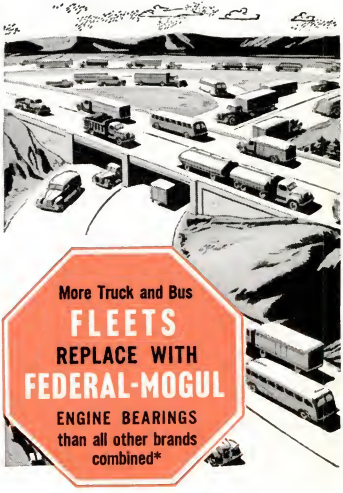

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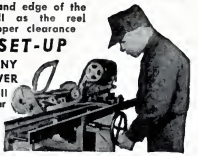

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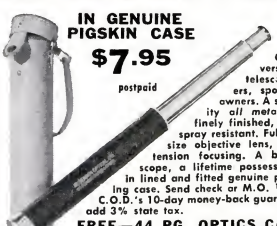

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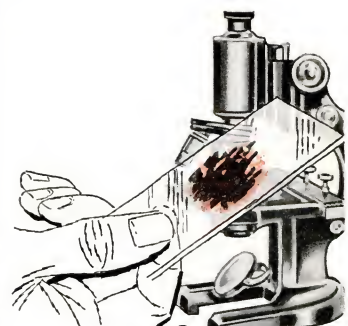

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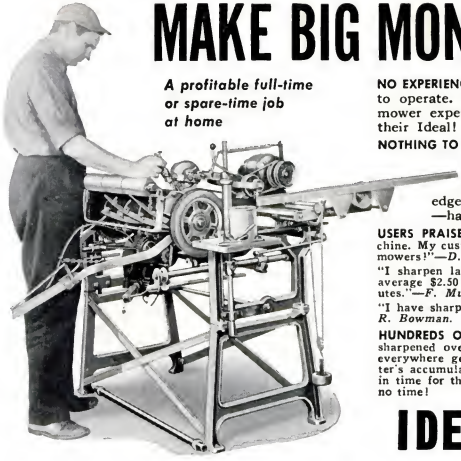

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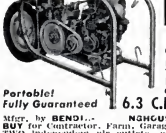

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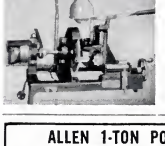

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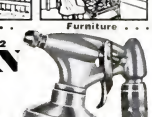

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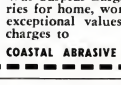

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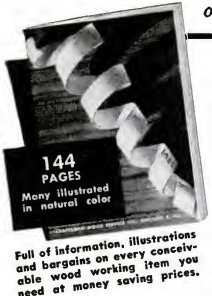

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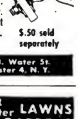

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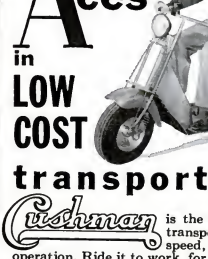

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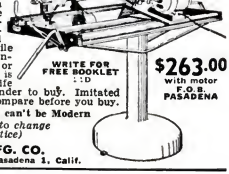

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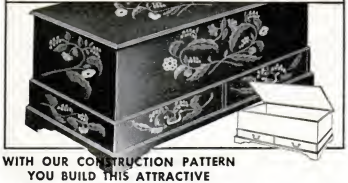

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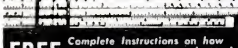

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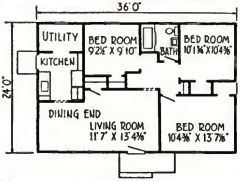

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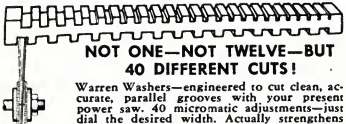

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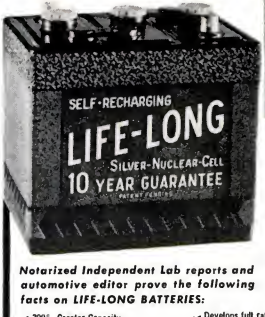

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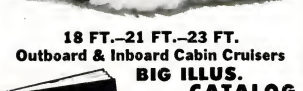

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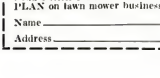

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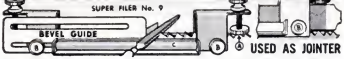

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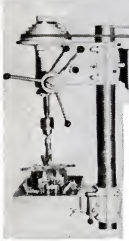

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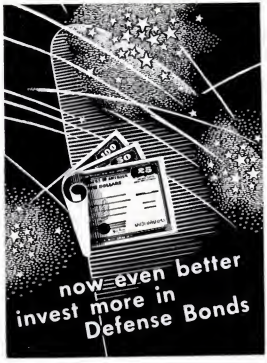

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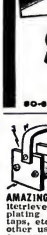

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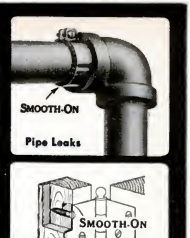

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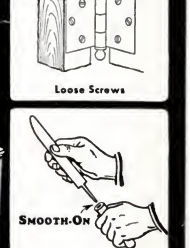

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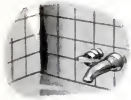

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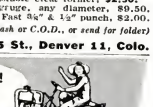

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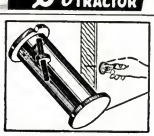

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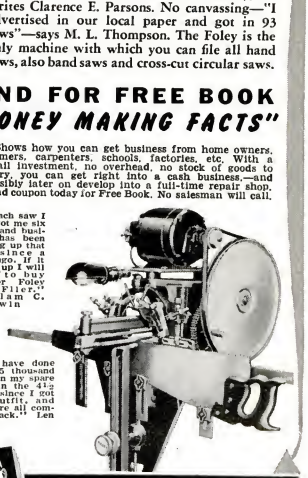

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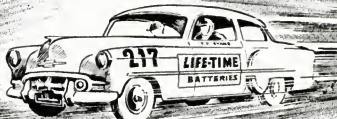

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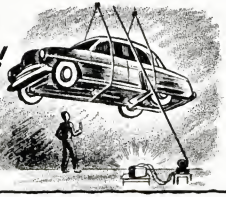

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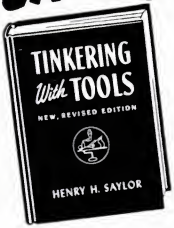

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Expert Testers Prepare New PSM Quiz

Was it worth your while to read this issue of Popular Science Monthly? All right, then, do you want to prove it?

Give yourself the test in the adjoining column. It was prepared by the attractive pair of young quizzers above. They are experts at asking questions. The gentleman is Stanford E. Taylor, head of New York's Educational Developmental Laboratories. The lovely lady is Helen Frackenpohl, a colleague who has collaborated with Taylor in writing four books on their special field of study.

Both hold master's degrees from New York University. Both are members of the staff of the Washington Square Reading Center, largest of its kind in the U. S.

Already, at 26, they are authorities on testing the reading ability of persons of all ages and all kinds of education. They have an armory of machines, including an eye-movement camera, for studying how a person's eyes and mind react to a page of print, as they're doing in the picture above.

Now they're going to feed you questions each month that will enable you to find how much you've seen and retained of the scientific and practical information in your current issue of PSM.

Nobody's keeping score but you. However, you might like to know that if you get fewer than half of the answers right, *we're* probably to blame; if you get at least seven right, you're in the groove; if you get them all right, maybe *you* ought to be asking the questions.

How Much Did You Learn?

Now you can sample how much you remember of the useful and interesting information packed into this issue of Popular Science Monthly. The quiz below was prepared by Stanford E. Taylor and Helen Frackenpohl of the Educational Developmental Laboratories and the Washington Square Reading Center, New York. After each answer is a page reference to the article on which the question was based.

1. ***Over 14 million Ford V-8 engines have been built since their introduction over***
   a. 18 years ago
   b. 21 years ago
   c. 25 years ago

2. ***Venezuela's new mountain superhighway, the world's most expensive road, cost***
   a. $6,000,000 a mile
   b. $600,000 a mile
   c. $60,000 a mile

3. ***In selecting flooring, remember that***
   a. any grade of wood will give a good sound floor
   b. higher grades are the most durable
   c. cheaper grades are less attractive

4. ***The amazing thing about the "flying wing" seed is***
   a. it can glide more than 1,000 feet
   b. its thin but strong wings
   c. the flexing ability of the wings

5. ***The main reason South Africa seems a plausible starting point for the human race is***
   a. its temperature has been unusually constant
   b. its land surface has remained relatively undisturbed through the centuries
   c. the first apes were found there

6. ***Studless partitions and closet walls are made possible by the use of***
   a. panels with internal structural supports
   b. gypsum backed with hardboard
   c. overlap technique in mounting gypsum

7. ***The automobile manufacturer with the largest production capacity is***
   a. Chevrolet
   b. Ford
   c. Plymouth

8. ***Joe Resnick built a 12-million-dollar business in six years by***
   a. manufacturing the first inexpensive TV antennas
   b. manufacturing the first preassembled TV antennas
   c. installing and servicing TV antennas

9. ***In using a glass cutter, the important thing is to***
   a. make your scratch uniform and unbroken
   b. make your scratch straight and true
   c. make your scratch deep enough

10. ***Building playground equipment and shelves with pipe is simple because of***
    a. new, faster cutting tools
    b. new aluminum connectors
    c. inexpensive bending equipment

Answers: 1. b—p. 136; 2. a—p. 110; 3. a—p. 241; 4. c—p. 128; 5. b—p. 172; 6. b—p. 211; 7. a—p. 132; 8. b—p. 117; 9. a—p. 187; 10. b—p. 201.

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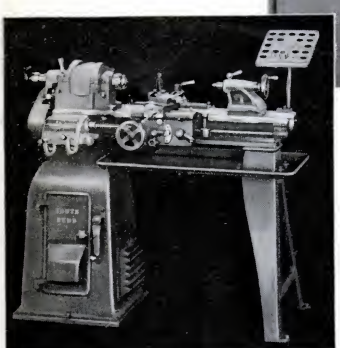

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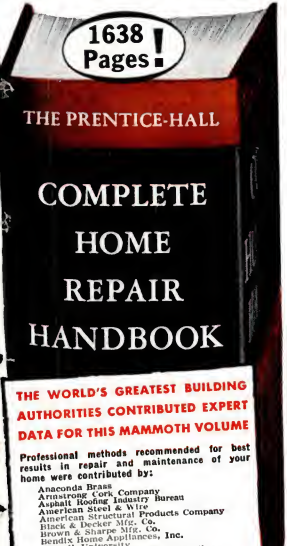

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EXTERIOR MAINTENANCE & REPAIRS. How to locate and repair leakage points on roofs—Roofing processes—Shingling—Built roofing—Repairs to gutters and leaders — Inspection and cleaning of septic tank—Patching cracks in concrete walks and walls—Removal of stains from concrete or brick—Exterior painting—How to avoid blistering, cracking, flaking, alligatoring, wrinkling on exterior paint jobs.

FURNITURE UPHOLSTERY & REPAIRS. How to replace defective stuffing, springs, webbing—How to pad seats—How to make cushions—Foam-rubber upholstering — Repairing broken splinter, rails, legs—Correcting sticky drawers—How to repair scratches, dents and nicks—Furniture refinishing.

HOME IMPROVEMENTS & APPLIANCES. Remodeling basements and attics—Constructing porch screens, storm doors and windows—Building a stairway closet—Constructing garden furniture, fences, gates, pergolas, trellis—Installing three-way push button electrical switch — Installing cooler fans in windows—Air conditioning systems —Automatic coal stoker—How to check and repair electric toaster, iron, mixer, range, vacuum cleaner, dish washer, refrigerator, oil burner—Laying a cement or concrete floor—Building concrete sidewalks, driveways, outdoor fireplace.

WOODWORKING HAND TOOLS & MATERIALS. How to use handsaws, screwdrivers, planes, chisels and gouges, brace and bits, scrapers, squares, levels, clamps, sharpening tools—How to identify and properly use woods and wood products—Working with wood—How to make woodworking joints —Glues and gluing—Glues.

METALWORKING HAND TOOLS & MATERIALS. Metalworking saws, hammers, twist drills, files, pliers and nippers, wrenches, snips and shears, cold hisels, taps and dies, soldering irons, vise —Bending and forming metal—Treating and finishing metal—Fasteners for metal work.

WOODWORKING POWER TOOLS. Proper use, checking, adjusting and maintenance of wood turning lathe, circular saw, band saw, drill press, jointers and shapers, sanders, power tool accessories—Cutting miters—Bend cutting—Beading and Fluting—Making dovetail joints—Cutting rabets and dados — Matched shaping — Tongue and grooving—Multiple cutting.

METALWORKING POWER TOOLS. Operation and maintenance of engine lathe, drill press, portable electric hand drill, power tool accessories—Roughing cuts—Finishing cuts—Facing—Boring—Taper turning — Knurling — Thread cutting — Drilling sheet metal—Countersinking—Commutators and carbon brushes.

PLUMBING & HEATING MATERIALS. Proper use and maintenance of all types of plumbing tools—Roughing-in rough work—Determining fixture house drains—Fittings—Selecting correct pipe size—Plumbing fixtures—Heating system s, hot water, steam, warm air—Stokers—Oil burners—Chimneys and drafts—Automatic heating controls —Domestic water heaters—Radiators and convectors—Radiant heating.

ELECTRICAL MATERIALS. Circuits — Outlets — Indoor and Outdoor Approved Wiring Materials—Batteries — Transformers — Tools — Splicing — Methods of interior wiring—Concrete-conduit wiring system—Use and repair of motors—Code requirements.

CONCRETE, PLASTERING, MASONRY. Methods of mixing concrete—Placing or pouring concrete—Cold-weather procedures—Waterlightness—Composition and application of stucco—Brick-laying—Concrete blocks—Cinder blocks—Tile—Roofing materials and procedures—Plaster cracks—Prepared gypsum finishes.

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